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## SHOP MANUAL

INSTRUCTIVO DE OPERACIÓN, CENTROS DE SERVICIO Y PÓLIZA DE GARANTÍA. **ADVERTENCIA:** LÉASE ESTE INSTRUCTIVO ANTES DE USAR EL PRODUCTO.

# DEWALT®

**DW168F, DW177F, DW188F  
Engines**

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## SERVICE

### Safety Information

#### Definitions: Safety Guidelines

The definitions below describe the level of severity for each signal word. Please read the manual and pay attention to these symbols.

**⚠DANGER:** Indicates an imminently hazardous situation which, if not avoided, **will** result in **death or serious injury**.

**⚠WARNING:** Indicates a potentially hazardous situation which, if not avoided, **could** result in **death or serious injury**.

**⚠CAUTION:** Indicates a potentially hazardous situation which, if not avoided, **may** result in **minor or moderate injury**.

**NOTICE:** Indicates a practice **not related to personal injury** which, if not avoided, **may** result in **property damage**.

**⚠DANGER:** If the service being performed requires the engine to be running operate it only outside in clean, dry, well-ventilated areas. Exhaust from the gasoline engine contains deadly carbon monoxide, which is odorless and toxic.

**⚠WARNING:** Risk of explosion. Spilled gasoline and its vapors can become ignited from sparks from smoking products, electrical arcing, exhaust, flame, gases and hot engine components such as the muffler. Wipe any fuel spillage from engine.

**⚠WARNING:** The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Wash hands after handling.

**⚠WARNING:** Risk of unsafe operation. Always wear gloves and certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields.

**⚠WARNING:** Stop engine and remove the spark plug wire before servicing.

**⚠WARNING:** Hot surfaces. Risk of burn. Engine (especially the muffler) and surrounding parts are very hot, do not touch. Allow engine to cool before servicing.

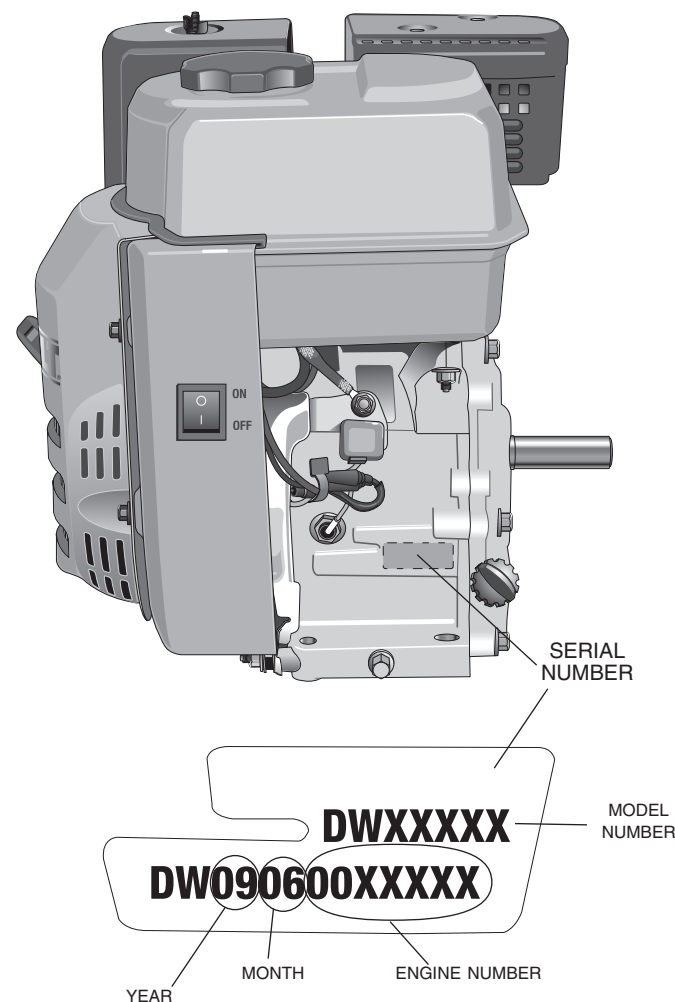
**⚠WARNING:** If protective covers must be removed during servicing keep away from moving parts and wires.

#### Service Information

- Always use identical replacement parts.
- Use tools designed for small engine repair, using incorrect tools could damage the engine.
- Replace all gaskets, O-rings, etc. when reassembling.
- Clean all parts in non flammable solvent. Lubricate any sliding surfaces before reassembly.

## Serial Number

The engine serial number is needed when ordering parts and making inquiries.



## SPECIFICATIONS

APPLICATION	GENERATOR		
MODEL	DW168F-2F	DW177FD-F	DW188FD-F
TYPE	Single Cylinder, 4 Stroke, OHV, Spark Ignition, Air Cooled		
MAX. HORSEPOWER *	6.5 hp	9 hp	13 hp
TOTAL DISPLACEMENT	196 cc	270 cc	389 cc
BORE AND STROKE	68 x 54 mm	77 x 58 mm	88 x 64 mm
RATED SPEED	3600 rpm	3600rpm	3600 rpm
MAX NO LOAD SPEED	3750 rpm.	3750 rpm.	3750 rpm.
IDLE SPEED	no idle control	2750 rpm.	2,750 rpm.
DRY WEIGHT	30.9 lbs. (14 kg)	57.6 lbs. (26.15 kg)	68.3 lbs. (31 kg)
DIMENSIONS (L X W X H) IN (mm)	15.2 x 13.1 x 10.4 (385 x 335 x 265)	17.3 x 16.5 x 12.2 (440 x 420 x 310)	16.1 x19.3 x 12.8 (410 x 490 x 325)
MOUNTING FLANGE	Flange A per SAE J609a	Flange B per SAE J609a	Flange B per SAE J609a
COMPRESSION RATIO	8.5 to 1	8.2 to 1	8.2 to 1
IGNITION SYSTEM	Transistorized Magneto Ignition	Transistorized Magneto Ignition	Transistorized Magneto Ignition
SPARK PLUG	NGK (BP6ES, BPR6ES)	NGK (BP6ES, BPR6ES)	NGK (BP6ES, BPR6ES)
CARBURETOR	Float type, adjustable idle speed	Float type with a fuel-shutoff solenoid, Adjustable idle speed	Float type with a fuel-shutoff solenoid, Adjustable idle speed
AIR CLEANER	Standard Semi-dry (foam), side mount	Standard Semi-dry (foam), side mount	Standard Semi-dry (foam), side mount
LUBRICATING SYSTEM	Splash	Splash	Splash
OIL CAPACITY	0.55 qt. (520 mL)	1.06 qt. (1000 mL)	1.11 qt. (1100 mL)
STARTING SYSTEM	Recoil, 2 o'clock position	18 V Electric motor and Recoil 2 o'clock position	18 V Electric motor and Recoil 2 o'clock position
STOPPING SYSTEM	Ignition primary circuit ground	Ignition primary circuit ground	Ignition primary circuit ground
FUEL USED	Regular gasoline (86 octane)	Regular gasoline (86 octane)	Regular gasoline (86 octane)
P.T.O. SHAFT ROTATION	Counterclockwise (from P.T.O. side)	Counterclockwise (from P.T.O. side)	Counterclockwise (from P.T.O. side)
CRANKSHAFT PTO	Ext. #5 per SAE J609a (2.25" taper per foot)	Ext. #6 per SAE J609a (2.25" taper per foot)	
GOVERNOR	Mechanical, centrifugal flyweight type, 60 Hz fixed speed		
FUEL LINE	Low permeation, per SAE J1737 at 40° C or higher		
FUEL FILTER	Either in gas tank or in fuel line (earlier models)		
ON/OFF SWITCH	Without	Without	Without

\* Gross horsepower (HP). This horsepower rating represents the maximum output under laboratory conditions at 3600 RPM in accordance with SAE (Society of Automotive Engineers) J1995 and should be used for comparison purposes only. Actual engine output will be lower and will vary depending on the application, speed and other variables including altitude and temperature.

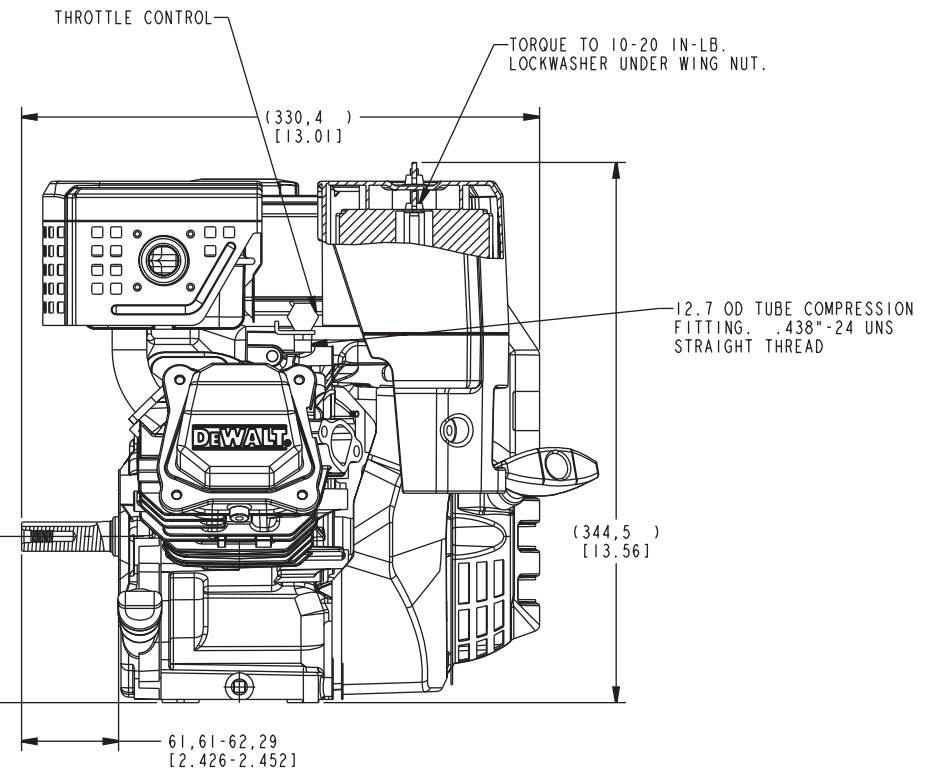
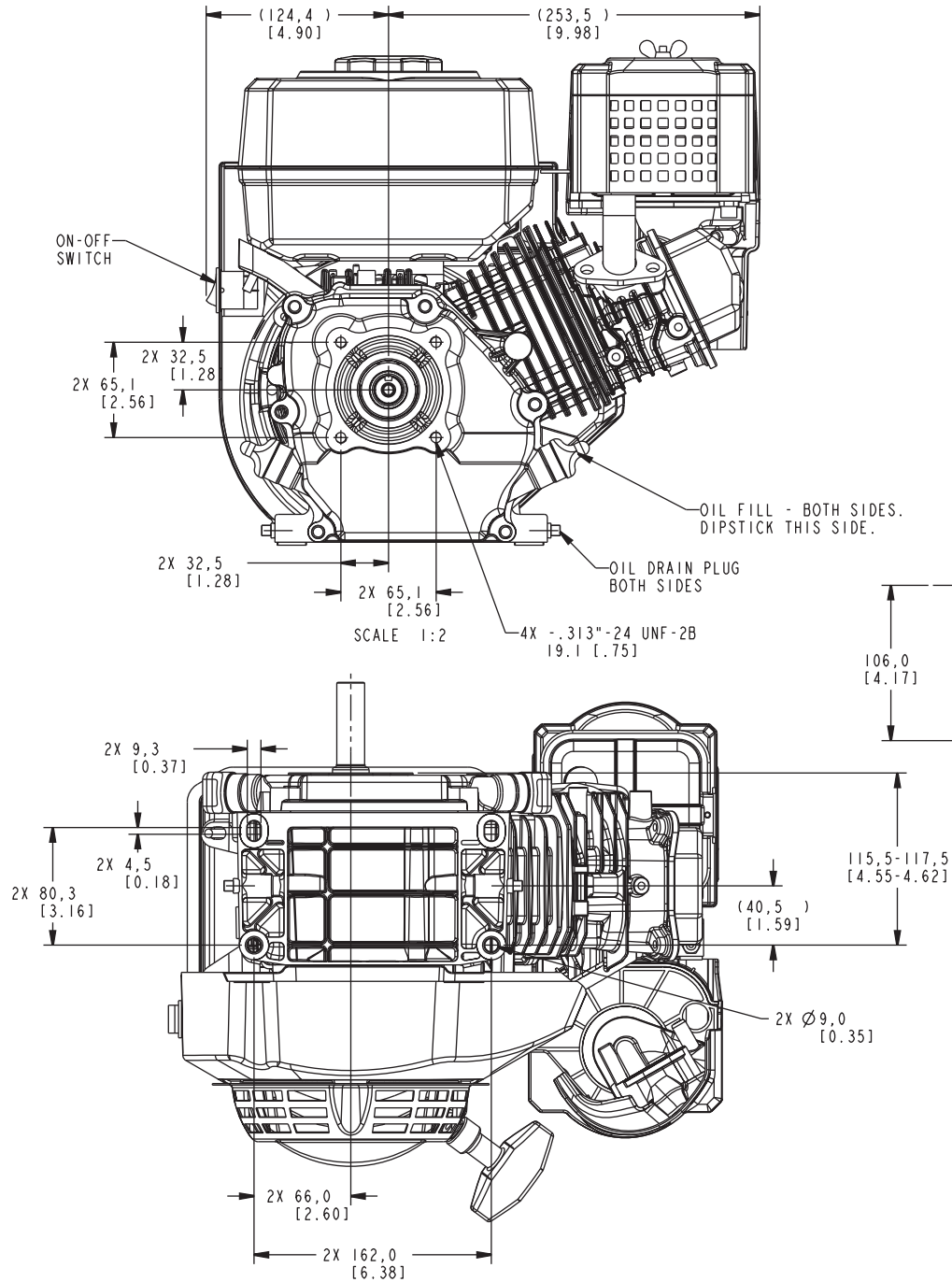


APPLICATION	PRESSURE WASHERS		
MODEL	DW168F-2H	DW177F-H	DW188F-H
TYPE	Single Cylinder, 4 Stroke, OHV, Spark Ignition, Air Cooled		
MAX. HORSEPOWER*	6.5 hp	9 hp	13 hp
TOTAL DISPLACEMENT	196 cc	270 cc	389 cc
BORE AND STROKE	68 x 54 mm	77 x 58 mm	88 x 64 mm
RATED SPEED	3400 rpm	3400 rpm	3600 rpm
MAX NO LOAD SPEED	3700 rpm	3700 rpm	3800 rpm
IDLE SPEED	no idle control	2750 rpm	2750 rpm
DRY WEIGHT	37.5 lbs. (17 kg)	57.3 lbs. (26 kg)	70.5 lbs. (32 kg)
DIMENSIONS (L X W X H) IN (mm)	15.7 x 13.0 x 13.4 (400 x 330 x 340)	16.9 x 15.6 x 16.1 (430 x 395 x 410)	18.7 x 17.3 x 17.1 (475 x 440 x 435)
MOUNTING FLANGE	Flange A per SAE J609a	Flange B per SAE J609a	Flange B per SAE J609a
COMPRESSION RATIO	8.5 to 1	8.2 to 1	8.2 to 1
IGNITION SYSTEM	Transistorized Magneto Ignition	Transistorized Magneto Ignition	Transistorized Magneto Ignition
SPARK PLUG	NGK (BP6ES, BPR6ES)	NGK (BP6ES, BPR6ES)	NGK (BP6ES, BPR6ES)
CARBURETOR	Float type, adjustable idle speed	Float type, adjustable idle speed	Float type, adjustable idle speed
AIR CLEANER	Standard Semi-dry (foam+paper), high mount	Standard Semi-dry (foam+paper), high mount	Standard Semi-dry (foam+paper), high mount
LUBRICATING SYSTEM	Splash	Splash	Splash
OIL CAPACITY	0.55 qt. (520 mL)	1.06 qt (1000 mL)	1.11 qt (1100 mL)
STARTING SYSTEM	Recoil, 10 o'clock position	Recoil, 10 o'clock position	Recoil, 10 o'clock position/Electric start
STOPPING SYSTEM	Ignition primary circuit ground	Ignition primary circuit ground	Ignition primary circuit ground
FUEL USED	Regular gasoline (86 octane, up to 10% ethanol)		
FUEL TANK CAPACITY	0.95 gal (3.6 L)	1.56 gal (5.9 L)	1.93 gal (7.3 L)
P.T.O. SHAFT ROTATION	Counterclockwise (from P.T.O. side)	Counterclockwise (from P.T.O. side)	Counterclockwise (from P.T.O. side)
CRANKSHAFT PTO	Ext. #3 per SAE J609a (3/4" key way PTO)	Ext. #4 per SAE J609a (1" key way PTO)	Ext. #4 per SAE J609a (1" key way PTO)
GOVERNOR	Mechanical, centrifugal flyweight type, variable speed		
FUEL LINE	Low permeation, per SAE J1737 at 40° C or higher		
FUEL FILTER	In gas tank only		
ON/OFF SWITCH	Equipped on recoil base	Equipped on recoil base	Equipped on recoil base
* Gross horsepower (HP). This horsepower rating represents the maximum output under laboratory conditions at 3600 RPM in accordance with SAE (Society of Automotive Engineers) J1995 and should be used for comparison purposes only. Actual engine output will be lower and will vary depending on the application, speed and other variables including altitude and temperature.			

APPLICATION	COMPRESSOR	
MODEL	DW168F-2E	DW177FD-E
TYPE	Single Cylinder, 4 Stroke, OHV, Spark Ignition, Air Cooled	
MAX. HORSEPOWER*	6.5 hp	9 hp
TOTAL DISPLACEMENT	196 cc	270 cc
BORE AND STROKE	68 x 54 mm	77 x 58 mm
RATED SPEED	3400 rpm	3400 rpm
MAX NO LOAD SPEED	3600 rpm	3600 rpm
IDLE SPEED	2400 rpm	2400 rpm
DRY WEIGHT	33 lbs. (15 kg)	57.3 lbs. (26 kg)
DIMENSIONS (L X W X H) IN (mm)	15.7 x 13.0 x 13.4 (400 x 330 x 340)	16.9 x 15.6 x 16.1 (430 x 395 x 410)
MOUNTING FLANGE	Flange A per SAE J609a	Flange B per SAE J609a
COMPRESSION RATIO	8.5 to 1	8.2 to 1
IGNITION SYSTEM	Transistorized Magneto Ignition	Transistorized Magneto Ignition
SPARK PLUG	NGK (BP6ES, BPR6ES)	NGK (BP6ES, BPR6ES)
CARBURETOR	Float type, adjustable idle speed	Float type, adjustable idle speed
AIR CLEANER	Standard Semi-dry (foam+paper), high mount	Standard Semi-dry (foam+paper), high mount
LUBRICATING SYSTEM	Splash	Splash
OIL CAPACITY	.507 qt (480 mL)	1.06 qt (1000 mL)
STARTING SYSTEM	Recoil, 10 o'clock position	18 V Electric motor and recoil starter 10 o'clock position
STOPPING SYSTEM	Ignition primary circuit ground	Ignition primary circuit ground
FUEL USED	Regular gasoline (86 octane, up to 10% ethanol)	
FUEL TANK CAPACITY	0.95 gal (3.6 L)	1.56 gal (5.9 L)
P.T.O. SHAFT ROTATION	Counterclockwise (from P.T.O. side)	Counterclockwise (from P.T.O. side)
CRANKSHAFT PTO	Ext. #3 per SAE J609a (3/4" key way PTO)	Ext. #4 per SAE J609a (1" key way PTO)
GOVERNOR	Mechanical, centrifugal flyweight type, variable speed	
FUEL LINE	Low permeation, per SAE J1737 at 40° C or higher	
FUEL FILTER	In gas tank only	
ON/OFF SWITCH	Equipped on recoil base	Equipped on recoil base
* Gross horsepower (HP). This horsepower rating represents the maximum output under laboratory conditions at 3600 RPM in accordance with SAE (Society of Automotive Engineers) J1995 and should be used for comparison purposes only. Actual engine output will be lower and will vary depending on the application, speed and other variables including altitude and temperature.		

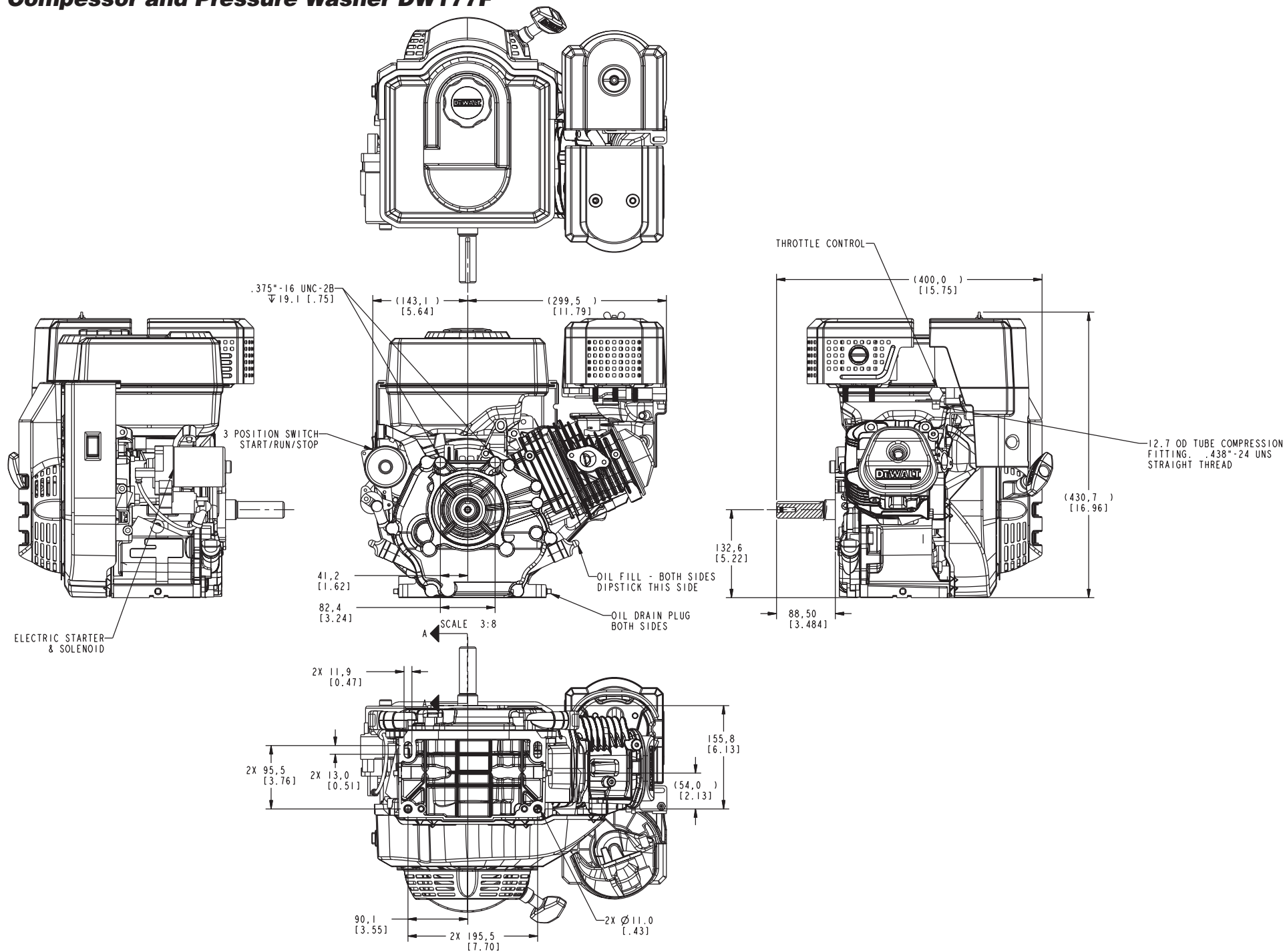
# **DIMENSIONAL DRAWINGS**

## **Pressure Washer DW168F**

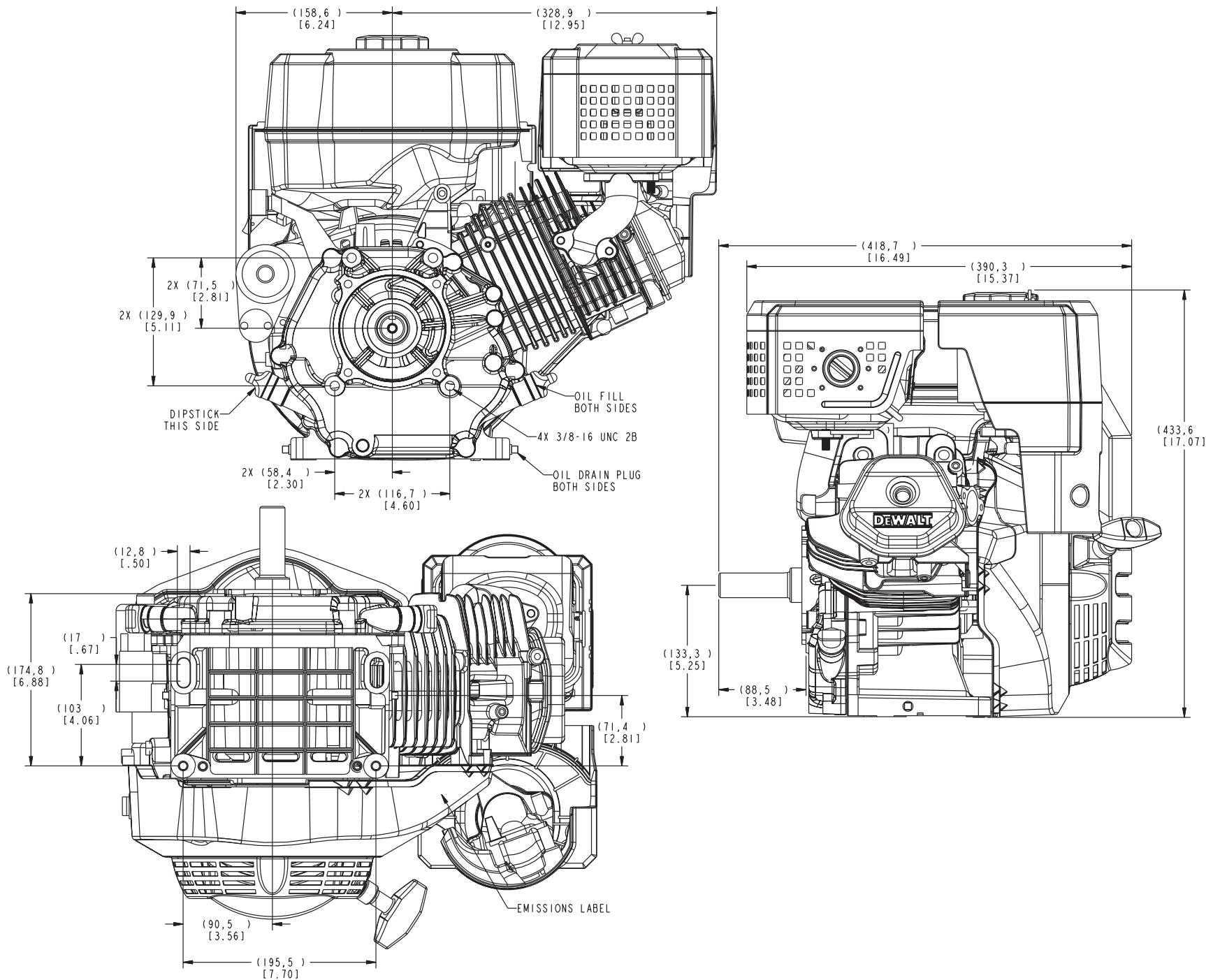


# **DIMENSIONAL DRAWINGS**

## **Compressor and Pressure Washer DW177F**



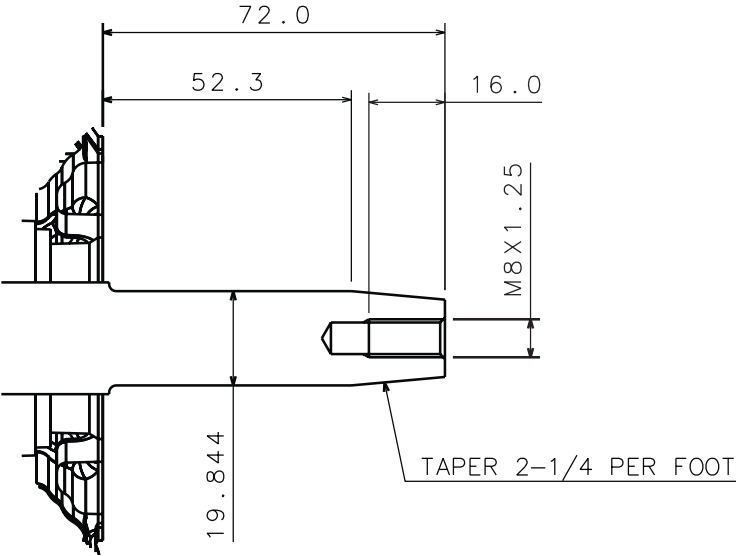
**DIMENSIONAL DRAWINGS**  
**Pressure Washer DW188F**



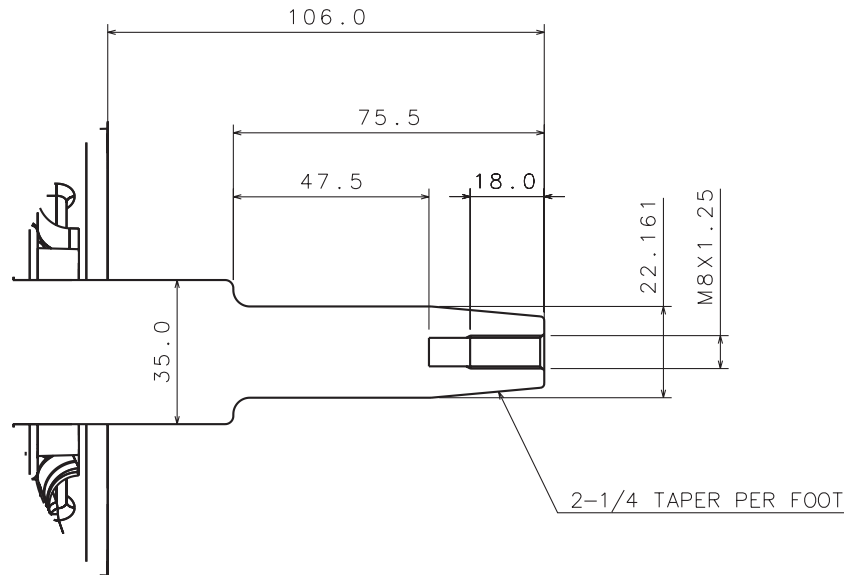
**P.T.O. DIMENSIONAL DRAWINGS**  
**Generator**

NOTE: All dimensions in mm unless noted otherwise

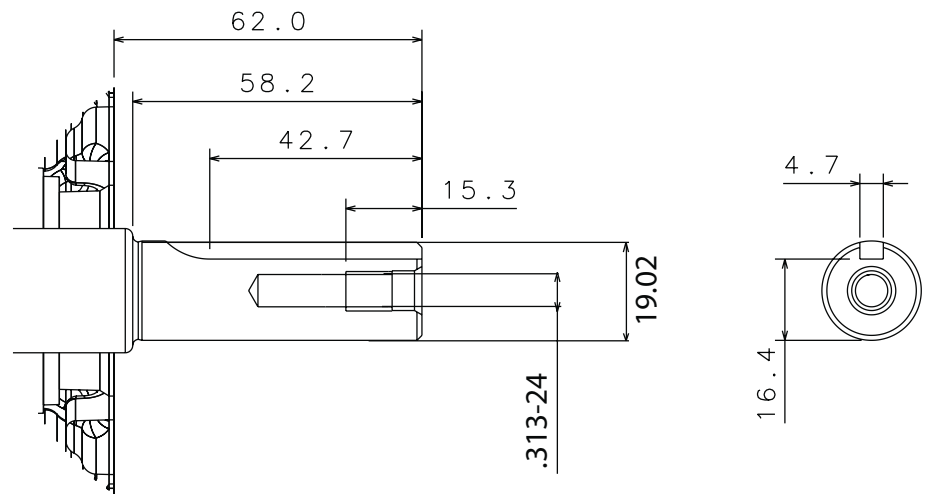
6.5 HP



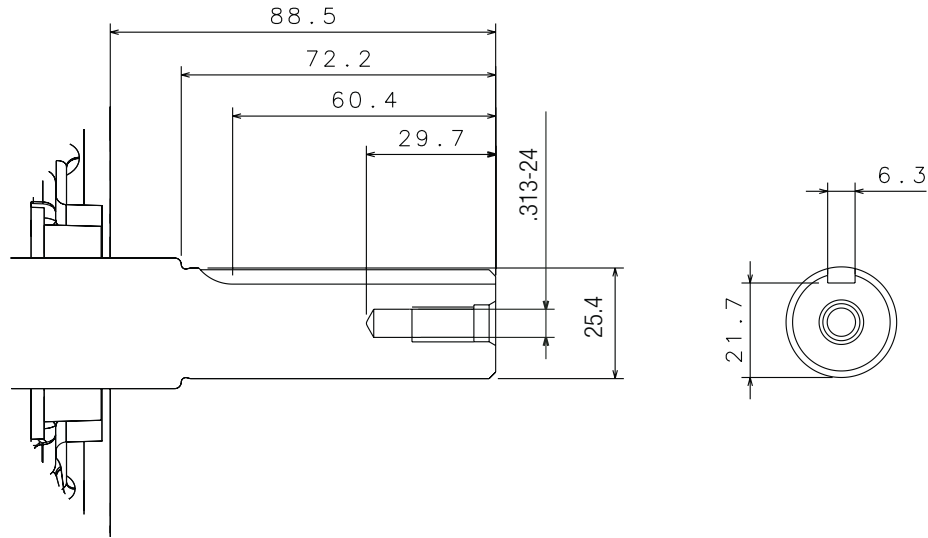
9-13 HP



**Pressure Washers and Compressors**  
**6.5 HP**



9-13 HP



WIRING DIAGRAMS

Electric start air compressor

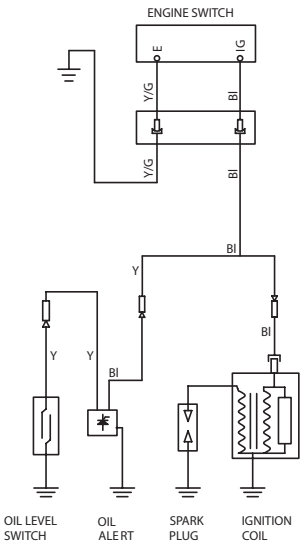
Non electric start

COMBINATION WIRE

Y	Yellow
Bl	Black
Y/G	Yellow /Green

COMBINATION SWITCH

	IG	E	ST	BAT
OFF				
ON				

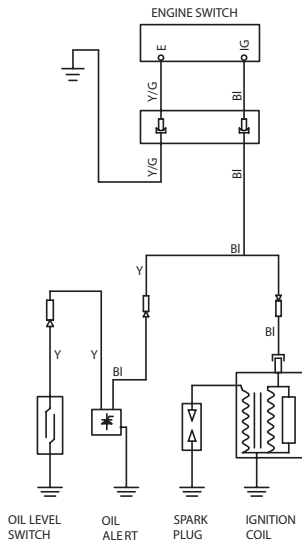


COMBINATION WIRE

Y	Yellow
Bl	Black
Y/G	Yellow /Green

COMBINATION SWITCH

	IG	E	ST	BAT
OFF				
ON				



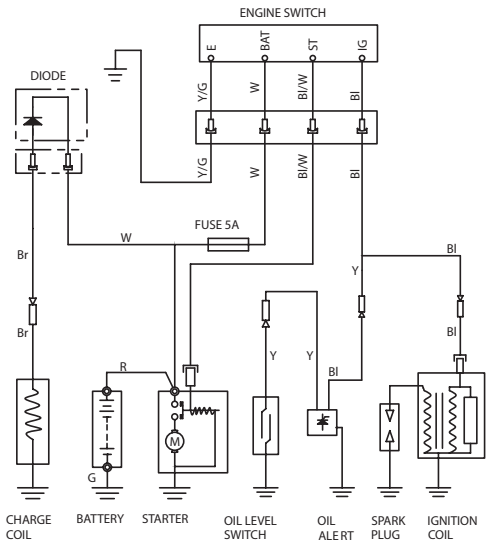
Electric start

COMBINATION WIRE

W	White	Br	Brown
Y/ G	Yellow Green	Bl/W	Black White
R	Red	Y	Yellow
G	Green	Bl	Black

COMBINATION SWITCH

	IG	E	ST	BAT
OFF				
ON				
START				

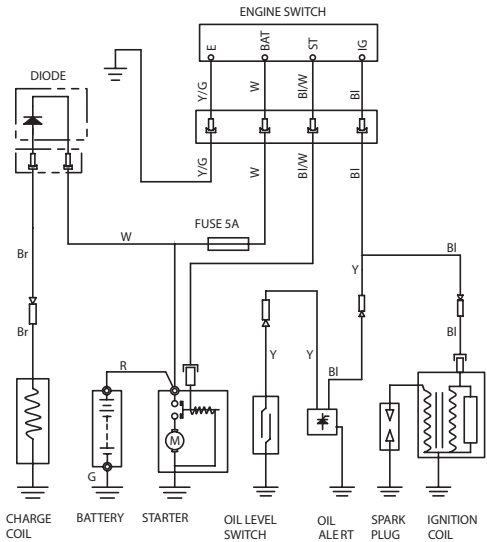


COMBINATION WIRE

W	White	Br	Brown
Y/ G	Yellow Green	Bl/W	Black White
R	Red	Y	Yellow
G	Green	Bl	Black

COMBINATION SWITCH

	IG	E	ST	BAT
OFF				
ON				
START				



# **MAINTENANCE STANDARDS**

PART	ITEM	DW168		DW177		DW188	
		*STANDARD (MM)	*SERVICE LIMIT (MM)	*STANDARD (MM)	*SERVICE LIMIT (MM)	*STANDARD (MM)	*SERVICE LIMIT (MM)
ENGINE	<i>Cylinder compression</i>	50 – 90 psi	-	60 – 100 psi	-	60 – 100 psi	-
CYLINDER	<i>Sleeve I.D.</i>	68.015~68.025	68.156	77.02~77.03	77.179	88.015~88.025	88.195
CYLINDER HEAD	<i>Warpage</i>	0	0.10	0	0.10	0	0.10
PISTON	<i>Skirt O.D.</i>	67.975~67.985	67.85	76.970~76.980	76.85	87.970~87.980	87.85
	<i>Piston-to-cylinder clearance</i>	0.030~0.050	0.12	0.040~0.060	0.1	0.045~0.065	0.1
	<i>Piston-to-piston pin bore clearance</i>	0.004~0.016	0.08	0.004~0.016	0.08	0.004~0.016	0.08
	<i>Piston Pin bore I.D.</i>	18.002~18.008	18.042	18.002~18.008	18.042	20.002~20.008	20.042
	<i>Pin O.D.</i>	17.992~17.998	17.94	17.992~17.998	17.95	19.992~19.998	19.94
PISTON RINGS	<i>Ring side clearance</i>						
	<i>Ring, Top</i>	0.08~0.12	0.10	0.02~0.06	0.15	0.02~0.06	0.15
	<i>Ring, Compression</i>	0.07~0.11	0.10	0.02~0.06	0.15	0.02~0.06	0.15
	<i>Ring Assy, Oil</i>	0.02~0.16	0.15	0.02~0.16	0.15	0.04~0.19	0.15
	<i>Ring end gap</i>	0.15~0.35	1.0	0.20~0.35	1.0	0.20~0.40	1.0
	<i>Ring width</i>						
	<i>Ring, Top</i>	1.420~1.440	1.3	1.97~1.99	1.75	1.97~1.99	1.75
	<i>Ring, Compression</i>	1.420~1.440	1.3	1.97~1.99	1.75	1.97~1.99	1.75
	<i>Ring Assy, Oil</i>	2.37~2.49	2.3	2.77~2.79	2.5	2.65~2.78	2.5
CONNECTING ROD	<i>Small end I.D.</i>	18.011~18.022	18.06	18.011~18.022	18.06	20.011~20.022	20.06
	<i>Big end I.D.</i>	30.02~30.03	30.06	33.02~33.03	33.06	36.02~36.03	36.06
	<i>Big end oil clearance</i>	0.030~0.055	0.1	0.029~0.055	0.1	0.029~0.064	0.1
	<i>Big end side clearance</i>	0.95~1.45	1.85	0.55~1.25	1.65	0.55~1.25	1.65
CRANKSHAFT	<i>Crankshaft O.D.</i>	29.975~29.990	29.92	32.975~32.991	32.92	35.966~35.991	35.92
VALVES	<i>Valve clearance</i>						
	<i>IN</i>	0.10~0.15	-	0.10~0.15	-	0.10~0.15	-
	<i>EX</i>	0.20~0.25	-	0.20~0.25	-	0.20~0.25	-
	<i>Stem O.D.</i>						
	<i>IN</i>	5.468~5.48	5.318	6.568~6.580	6.44	6.568~6.580	6.44
	<i>EX</i>	5.418~5.44	5.275	6.545~6.560	6.40	6.545~6.560	6.40
	<i>Guide I.D. IN/EX</i>	5.500~5.512	5.572	6.600~6.615	6.66	6.600~6.615	6.66
	<i>Stem clearance</i>						
	<i>IN</i>	0.020~0.044	0.1	0.020~0.070	0.11	0.020~0.070	0.11
	<i>EX</i>	0.060~0.084	0.12	0.040~0.070	0.15	0.020~0.070	0.15
	<i>Seat width</i>	0.7~0.9	2.0	0.8~1.0	2.0	0.7~0.9	2.0
	<i>Spring free length</i>	30~31	29.0	38.5~39.5	37.5	38.5~39.5	37.5

\* unless otherwise noted



PART	ITEM	DW168		DW177		DW188	
		*STANDARD (MM)	*SERVICE LIMIT (MM)	*STANDARD (MM)	*SERVICE LIMIT (MM)	*STANDARD (MM)	*SERVICE LIMIT (MM)
CAMSHAFT	<i>CAM height</i>						
	<i>IN</i>	27.700	27.45	31.716	31.35	32.585	32.25
	<i>EX</i>	27.747	27.50	31.754	31.35	32.068	31.80
	<i>Camshaft O.D.</i>	13.966~13.984	13.916	15.966~15.984	15.92	15.966~15.984	15.92
CRANKCASE COVER	<i>Camshaft holder I.D.</i>	14.000~14.018	14.05	16.000~16.018	16.05	16.000~16.018	16.05
SPARK PLUG	<i>Gap</i>	0.7 ~ 0.8	-	0.7 ~ 0.8	-	0.7 ~ 0.8	-
SPARK PLUG BOOT	<i>Resistance</i>	10k	7.5 – 10.5 k	10k	7.5 – 10.5 k	10k	7.5 – 10.5 k
IGNITION COIL	<i>Resistance</i>						
	<i>Primary</i>	1.3Ω±0.2Ω	-	1.3Ω±0.2Ω	-	1.3Ω±0.2Ω	-
	<i>Secondary</i>	6.4kΩ±1kΩ	-	6.4kΩ±1kΩ	-	6.4kΩ±1kΩ	-
	<i>Air gap</i>	0.4±0.2	-	0.4±0.2	-	0.4±0.2	-
STARTER MOTOR	<i>Brush length</i>	10	5.5	10	5.5	10	5.5

\* unless otherwise noted

## TORQUE TABLE

ITEM	TORQUE			
	168 (N- M)	177/188 (N- M)	168 (FT-LB)	177/188 (FT-LB)
CONNECTING ROD BOLT	12-14	14-16	10	12
CYLINDER HEAD BOLT	32-35	50-55	26	41
FLYWHEEL NUT	80-90	90-115	66	85
ROCKER ARM PIVOT BOLT	28-32	28-32	24	24
CRANKCASE COVER BOLT	27-30	27-30	22	22
OIL LEVEL SWITCH JOINT NUT	6-8	6-8	6	6
FUEL FILTER, JOIN NUT	6-8	6-8	6	6
MUFFLER MOUNTING NUT	27-30	27-30	22	22
AIR CLEANER WING NUT	8-12	8-12	9	9
OIL DRAIN BOLT	20-25	25-30	18	18
FUEL TANK BOLT, NUT	8-10	8-10	7	7
AIR CLEANER MOUNTING NUT	1-2	1-2	1	1
UNSPECIFIED TORQUE VALUES				
BOLT, NUT	5-7	5-7	5	5
6MM BOLT, NUT	8-12	8-12	9	9
8MM BOLT, NUT	24-28	24-28	21	21
10MM BOLT, NUT	50-55	50-55	41	41
GOVERNOR ARM RETAINER BOLT	7-9	7-9	5.2-6.6	5.2-6.6

## MAINTENANCE

Procedure	Daily	50 hours or weekly (whichever comes first)	100 hours	150 hours or monthly (whichever comes first)	500 Hours
Clean engine exterior		X			
Clean battery pack and charger				X	
Check oil level	X				
Change oil *			X(1)		
Clean air filter			X(1)		
Clean spark plugs					X
Check fuel line, hose clamps and fuel tank	X				
Oil leak inspection	X				
Spark arrestor			X		
Sediment cup					X
Clean inline fuel filter				X	
Check for unusual noise/vibration	X				
Check and adjust valve clearance (.15 mm intake, .2 mm exhaust)				X	
Prepare unit for Storage	Prepare unit for storage if it is to remain idle for more then 30 days				
* The engine oil must be changed after the first 20 hours or operation. Thereafter change oil every 100 hours of operation or monthly, whichever comes first.					
(1) Perform more frequently in dusty or humid conditions					

### SPARK PLUG CONDITION CHECK

- Remove the spark plug for inspection
  - Always use recommended plug see *Specifications*
  - Set gap to specification, see **Spark Plug** under *Maintenance Standards*.
- Normal Plug** – Slightly rounded electrodes with light coat of ashy brown deposits indicate normal wear and a healthy engine.
  - Oil Fouling** – Wet oily film will prevent the plug from sparking. This condition signals worn valves or piston rings. This condition can be caused by running the engine in the choke position. Check valves and piston rings, overhaul if needed. Replace spark plug.
  - Carbon Fouling** – Black dry soot covering the electrodes indicates incomplete combustion. This can be a result of weak ignition or a rich mixture.
    - Check carburetor adjustment, adjust speed if needed.
    - Check air filter, clean if needed.
  - Gap Bridging** – A combustion particle lodged between the electrodes carries current across the gap. This does not normally signal engine problems elsewhere.
  - Whitened Electrodes** – This is evidence combustion is too hot and there is overheating. This can result from too lean fuel mixture.

- Make sure spark plug is correct type, see **Spark Plug** under *Maintenance Standards*.
  - Ignition timing malfunction. Set ignition air coil gap, see the **Flywheel Ignition Adjustment** section.
- Excessive Wear** – Plug worn to the point of having encrusted deposits and thin rounded out electrodes. Replace plug.

### Cleaning Air Filter Element

**⚠WARNING:** Hot surfaces. Risk of burn. Engine and surrounding parts are very hot, do not touch. Allow engine to cool prior to servicing.

A dirty air cleaner will restrict airflow to the carburetor. To prevent carburetor malfunction, service the air filter regularly. Service more frequently when operating the generator in extremely dusty areas.

**⚠WARNING:** Using gasoline or flammable solvent to clean the filter element can cause a fire or explosion.

**⚠WARNING:** Risk of fire. Do not operate without air filter.

#### TO CLEAN THE ELEMENTS

(DW168F-2E, DW177F-E, DW168F-2H, DW177F-H)

- Remove the wing nut and the air filter cover.
- Remove the second wing nut and remove the filter.
- Remove the foam-type pre-filter from the filter.
- Inspect foam and paper elements. Replace them if damaged.

#### TO CLEAN THE ELEMENTS

**Foam element:** Wash element in warm, soapy water. Then saturate it in clean engine oil. Squeeze the element to remove excess oil.

**Paper element:** Clean element by tapping gently to remove dust. Use compressed air to blow off dust.

**⚠WARNING:** When using compressed air, user always must wear eye protection that conforms to ANSI Z87.1. (CAN/CSA Z94.3).

Never use oil. Always blow the element from the inside. If using compressed air keep the air pressure less than 30 psi.

Place the foam pre-filter over the paper element and reinstall it onto the engine.

(DW168F-2F, DW177FD-F, DW188F)

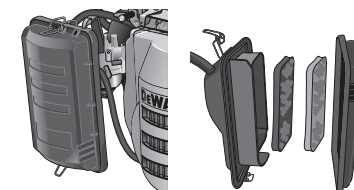
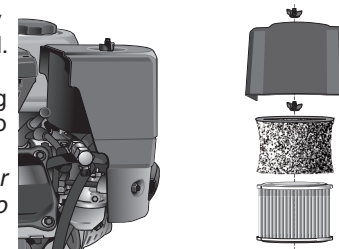
- Unsnap the air filter cover clips and remove the air cleaner cover.
- Remove the elements from air filter.
- Wash elements in warm soapy water and rinse thoroughly. Allow the elements to dry thoroughly.
- Soak the elements in clean engine oil and squeeze out the excess oil. **NOTE:** The engine will smoke during initial start-up if too much oil is left in the elements.
- Reinstall the air filter elements and snap air filter cover in place.

### Oil

**⚠WARNING:** Hot surfaces. Risk of burn. Engine and surrounding parts are very hot, do not touch. Allow engine to cool prior to servicing.

#### TO CHECK OIL

- Place unit on a flat level surface.



2. Remove oil fill/dipstick and wipe clean.
3. Reinsert oil fill/dipstick fully into oil fill port and tighten. Allow oil to collect on the dipstick for a few seconds.
4. Remove oil fill/dipstick to read oil level. If oil falls below top of pattern on dipstick, add oil.

**NOTE:** When filling the crankcase, allow the oil to flow very slowly. If the oil is added too quickly, it will overflow and appear to be full.

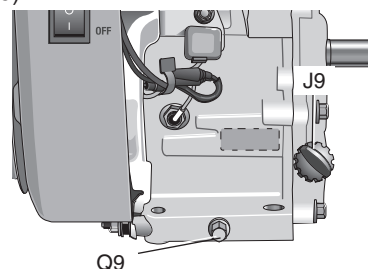
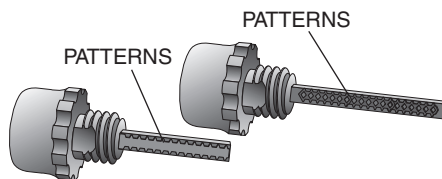
5. Replace dipstick and tighten securely.

## TO CHANGE OIL

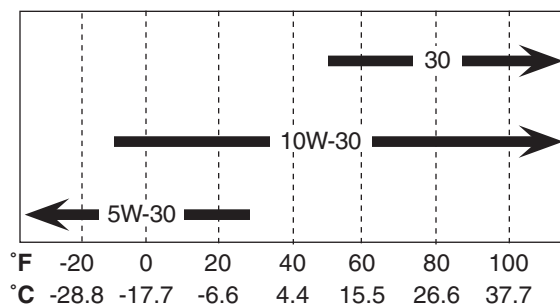
**NOTE:** Engine oil contains substances that are regulated and must be disposed of in accordance with local, state, provincial and federal laws and regulations.

1. Disconnect spark plug wire.
2. Locate a suitable container under oil drain plug (Q9).
3. Remove the oil fill/dipstick (J9) from crankcase.
4. Remove the oil drain plug.
5. Allow ample time for all oil to drain out.
6. Install the oil drain plug and tighten securely.
7. Fill with recommended oil. Refer to the Viscosity-Ambient Temperature Chart for recommended oil.

**NOTE:** Synthetic oil is NOT recommended.



**VISCOSITY-AMBIENT TEMPERATURE CHART**



8. Replace dipstick and tighten securely.
9. Reconnect spark plug wire.
10. Dispose of oil according to local, state, provincial and federal laws and regulations.

## Spark Plug

Use recommended spark plugs, see Spark Plug Cross Reference for correct spark plug. To ensure proper engine operation, the spark plug must be properly gapped and free of deposits.

**⚠WARNING:** If the engine has been running, the muffler and spark plug will be very hot. To reduce the risk of injury, allow cooling before proceeding.

**⚠WARNING:** Always wear certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields.

## SPARK PLUG CROSS REFERENCE

BRAND	PART NUMBER
NGK	BP6ES, BPR6ES
AUTOLITE	63
AC DELCO	R41XL, R42XLS, R43FS, R43XL, R43XLS, R44XLS, R45XLS
CHAMPION	RJ14YC

1. Remove the spark plug boot.
2. Clean any dirt from around the spark plug base.
3. Use a spark plug wrench (not supplied) to remove the spark plug.
4. Visually inspect the spark plug. Replace it if the insulator is cracked or chipped. Clean the spark plug with a wire brush if it is going to be reused.
5. Measure the plug gap with the feeler gauge. Correct as necessary by carefully bending the side electrode. The gap should be: 0.70-0.80 mm (0.028-0.031 in).
6. Make sure the spark plug washer is in good condition. Thread the spark plug in by hand to prevent cross threading.
7. After the spark plug is seated, tighten with a spark plug wrench to compress the washer. If installing a new spark plug, tighten the spark plug 1/2 turn after it seats to compress the washer. If reinstalling a used spark plug, tighten 1/8-1/4 turn after the spark plug seats to compress the washer. Do not overtighten.



**NOTE:** The spark plug must be securely tightened. An improperly tightened spark plug can become very hot and could damage the engine. Never use spark plugs which have an improper heat range. Use only the recommended spark plugs or equivalent.

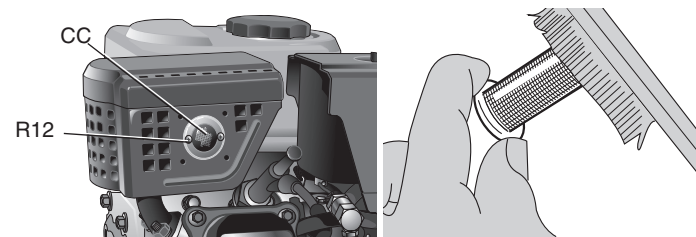
## Spark Arrester

**⚠WARNING:** DO NOT operate engine without muffler cover or spark arrestor.

**⚠WARNING:** If the engine has been running, the muffler will be very hot. To reduce the risk of injury, allow engine to cool before proceeding.

**⚠WARNING:** Always wear certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields when removing carbon deposits.

**NOTE:** The spark arrestor must be serviced every 100 hours to maintain its efficiency.



1. Remove the spark arrestor screws (R12) and remove the spark arrestor (CC).
2. Use brush to remove carbon deposits from the spark arrestor screen. Inspect the spark arrestor screen for holes or tears. Replace the spark arrestor if necessary.

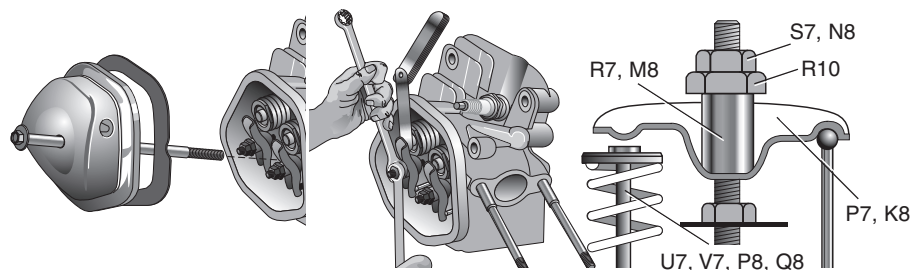
## Valve Clearance

**⚠WARNING:** Hot surfaces. Risk of burn. Engine and surrounding parts are very hot, do not touch. Allow engine to cool prior to servicing.

**NOTE:** Engine must be cold to check the valve clearance.

1. Remove the cylinder head cover.

- Set the piston in the top dead center position of its compression stroke.  
**NOTE:** both rocker arms (P7, K8) will have the largest gap with each valve (U7, V7, P8, Q8).
- Insert a feeler gauge between the rocker arm and valve to measure valve clearance.



		STANDARD (MM)	SERVICE LIMIT (MM)
VALVE CLEARANCE	IN	0.10~0.15	-
	EX	0.20~0.25	-

- Adjust rocker arm pivot (R7, M8) by loosening the rocker arm locknut (S7, N8) and adjust the pivot lock nut (R10) until the clearance is correct. When clearance is correct tighten the rocker arm locknut.
- Check the clearance again with nuts tightened.

## Fuel System

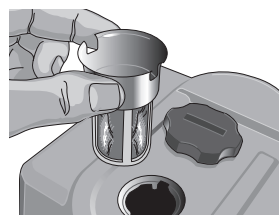
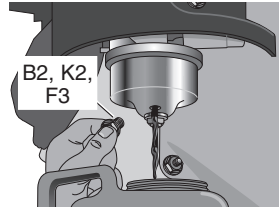
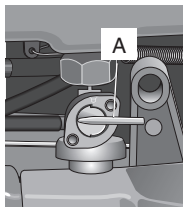
**IMPORTANT:** If the engine does not start, is hard to start or is performing poorly ensure fuel system is clean and fuel tank contains fresh gasoline before troubleshooting.

**⚠WARNING: Risk of explosion.** Spilled gasoline and it's vapors can become ignited from sparks from smoking products, electrical arcing, exhaust, flame, gases and hot engine components such as the muffler. Make sure there are no sources of ignition, such as smoking products near servicing location. Wipe any fuel spillage from engine.

**⚠WARNING: Hot surfaces. Risk of burn.** Engine and surrounding parts are very hot, do not touch. Allow engine to cool prior to servicing.

## DRAIN CARBURETOR

- Place the fuel shut off valve (A, if equipped) in the closed (horizontal) position as shown.
- Place an OSHA-approved container suitable for fuel under the carburetor bowl. **NOTE:** Using a funnel will allow the fuel to flow into the container with less spillage.
- Remove the carburetor bowl drain bolt (B2, K2, F3).
- Fuel will drain from carburetor bowl.
- Remove the carburetor bowl and clean it in nonflammable or high flash point solvent.



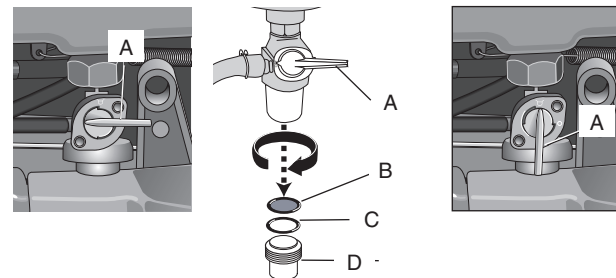
## CLEANING DEBRIS SCREEN (IF EQUIPPED)

- Remove fuel cap.
- Remove debris screen.
- Clean debris screen. Use compressed air to blow off debris.

**⚠WARNING:** When using compressed air, user always must wear eye protection that conforms to ANSI Z87.1. (CAN/CSA Z94.3).

## FUEL SEDIMENT CUP CLEANING (IF EQUIPPED)

- Place the fuel shut off valve (A, if equipped) in the closed (horizontal) position as shown.



- Remove the sediment cup (D) from the fuel valve on the bottom of the tank.
- Clean the sediment cup, screen (C) and O-ring (B) in nonflammable or high flash point solvent.
- Drain and remove gas tank, flush until clean.
- Replace or clean fuel filter. Fuel filter may be inside gas tank where fuel exits or an in line fuel filter may be on the fuel line. See **Service Bulletin** (SB06109)

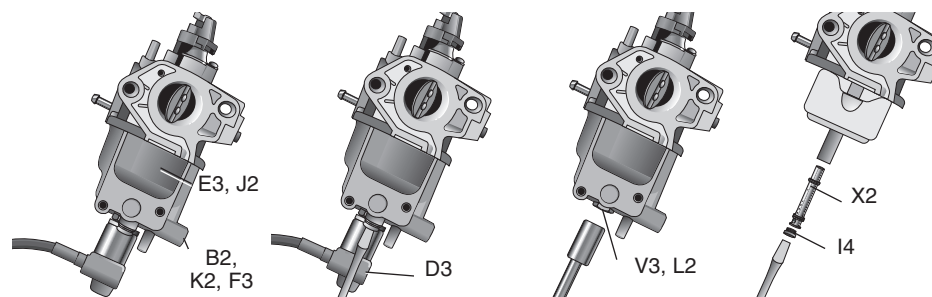
## REASSEMBLE

- Reinstall O-ring, sediment cup, carburetor bowl, carburetor bowl drain bolt, debris screen and fuel cap.
- Replace inline filter (if equipped).
- Turn the fuel shut-off valve (A, if equipped) to the open (vertical) position and check for fuel leaks.

## High Altitude Operation Service

High Altitude Modification should only be made to engines operating at above 5,000 ft. (1524 m) for an extended period as manufactured engines are suitable for operation up to 5,000 ft. (1524 m) above sea level. **NOTE:** Reset to factory setting immediately when engine is moved to operate below 5,000 ft. (1524 m). To reset, replace high altitude main jet with low altitude main jet. If the engine is used at low altitudes after a carburetor modification, the carburetor may cause the engine to overheat and result in serious engine damage.

- Set the fuel valve in the off position. Remove the carburetor drain bolt (B2, K2, F3) from the carburetor bowl (E3, J2) and allow fuel to drain into a suitable container.
- Remove the fuel cutoff solenoid (D3, if equipped) from the carburetor bowl using a Phillips screwdriver.



- Remove the carburetor bowl (E3, J2) and retaining bolt (V3, L2) with a 14 mm socket.



4. Remove the main jet (I4) and e-tube (X2), with a flat head screwdriver.
5. Replace the main jet with the main jet specified for high altitude service. This high altitude main jet comes in a high altitude carburetor adjustment package with new carburetor bowl and fuel shut-off solenoid O-rings.
6. Reassemble carburetor in reverse order. Replace carburetor bowl O-ring and solenoid O-ring if necessary.
7. Turn on fuel valve and inspect for fuel leak.

## TROUBLESHOOTING

**NOTE:** Make sure the engine has a good ground before troubleshooting.

### Engine

#### STARTING PROBLEM

PROBLEM	POSSIBLE CAUSE	SOLUTION
Engine will not start, stay running or only runs when choked	1. On/Off switch in OFF position	Place On/Off switch in ON position.
	2. Low or no fuel	Add fuel.
	3. Fuel valve in OFF position	Place fuel valve in ON position.
	4. Low oil or no oil	Add oil.
	5. Choke in wrong position	For cold starts, choke must be in CLOSED position. On pull ring chokes, pull ring all the way out. On lever chokes, move lever all the way in direction of arrow. If in doubt, remove air cleaner and visually verify that choke plate is closed and completely blocking entrance.
	6. Check fuel condition	Ensure fuel is clean and fresh. If problem continues refer to <b>Fuel System</b> under <i>Maintenance</i> .
	7. Spark plug wire (is loose on plug)	Ensure that spark plug wire is tightly connected to spark plug
	8. Low oil shutdown (LOS)	Make sure oil level is up to full mark, refer to <b>Oil</b> under <i>Maintenance</i> . If problem continues refer to <b>Inspection/Oil Level Switch</b> under <i>Governor/Low Oil Shutoff</i> .
	9. Check for spark	Perform <b>Ignition Test</b> under <i>Perform Test Checks</i> .
	10. Examine spark plug condition	Perform <b>Spark Plug Condition Check</b> under <i>Maintenance</i> .
	11. Improper valve clearance	Reset valve clearances (see <i>Maintenance Standards</i> )
	12. Cap not venting	After performing <b>Fuel Check</b> , if problem still continues: Run engine with gas cap loose or removed to see if engine still stalls. If it does not stall, gas cap is not venting. <b>NOTE:</b> California models of generators and pressure washers have non-venting gas caps for emissions. Venting air is supplied from carbon canister.  If gas cap is not venting properly the fuel filter could be dirty or blocked, sediment cup full of debris or fuel valve could be clogged.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Engine will not start, stay running or only runs when choked ( <i>continued</i> )	13. Gas tank/fuel filter does not allow flow of gas because it is dirty or blocked	There are 2 types of gas tank/fuel filter designs used: One requires an in-line filter located in the fuel line between the fuel valve and the carburetor. The other has a tube shaped filter above the fuel valve inside the gas tank. This second design does not require an in-line filter. To check the gas tank/fuel filter, place fuel valve lever in the closed (horizontal) position, remove fuel line from fuel valve and place fuel valve lever in the on (vertical) position to check flow to a catch pan. If there is flow and the engine has only the internal tank filter, the filter is not the problem. If there is no flow, , place fuel valve lever in the closed (horizontal) position, remove fuel valve to access tube filter, clean it and reassemble. To check in line filter disconnect fuel line from carburetor and place fuel valve lever in the on (vertical) position to check for fuel flow. If no flow or weak, replace fuel filter. See Service Bulletin SB06109 regarding filters. <b>NOTE:</b> Air Compressors and Pressure Washers have a fuel valve in the carburetor. On these remove drain screw on carburetor bowl to verify flow.
	14. Sediment cup full of debris (fuel valve)	Place the fuel valve lever in the closed (horizontal) position, remove fuel line from fuel valve and place fuel valve lever in the on (vertical) position to check flow to a catch pan. If no flow or weak, clean sediment cup, refer to <b>Fuel System</b> to clean the sediment cup. With sediment cup removed from fuel valve, place fuel valve lever in the ON position to verify flow from cup area into a catch pan. This will confirm fuel valve itself is not clogged.
	15. Fuel valve clogged	Remove valve from generator tank and with valve in the OPEN position use compressed air to blow it clean or soak it in solvent. Or replace valve.
	16. Evaporative system not venting fresh air to tank to replace gas as being used. (California Units)	Ensure no obstructions, kinks or blockages are in evaporative system hose connected to bottom of gas tank and to charcoal canister on lower frame. Disconnect hose from canister that goes to tank. With gas cap removed, blow through hose. Air should flow freely. If not find obstruction and correct. <b>NOTE:</b> On California versions of pressure washers, evaporative system hose exits from top of gas tank.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Engine will not start, stay running or only runs when choked (continued)	17. Vacuum leak at carburetor	Ensure the evaporative system hose from the charcoal canister is connected firmly to port behind carburetor and other evaporative hoses are connected firmly. Ensure carburetor is tightly secured to engine by the two mounting nuts inside air cleaner
	18. No or low compression	Refer to <b>Compression Test</b> under <i>Perform Test Checks</i> .
	19. Dirty air filter	Ensure air cleaner is clean and not blocking air from entering carburetor. Clean if necessary.
Engine will not turn over, engine seized	1. Battery is dead (Electric start)	Try fully charged battery. Replace battery pack if needed.
	2. Recoil pull starter rope broken	Replace pull start rope. Refer to <b>Recoil Starter/Assemble Recoil Starter</b> under <i>Breakdowns</i> .
	3. Recoil pull start not engaging engine	Remove recoil assembly. Repair or replace as necessary. Refer to <b>Recoil Starter/Assemble Recoil Starter</b> under <i>Breakdowns</i> .
	4. Cylinder filled with gas.	Remove spark plug and tip engine momentarily. If gas pours out hole, carburetor float bowl needle is stuck open. Clean or replace carburetor. Refer to <b>Carburetor</b> under <i>Breakdowns</i> for cleaning instructions. <b>NOTE:</b> When transporting unit fuel valve must be in OFF position, if not flooding will occur."
	5. Electric starter motor faulty	Refer to <b>Start Mechanism</b> under <i>Perform Test Checks</i> and <b>Starter Motor</b> under <i>Breakdowns</i> for checks.
	6. Excessive carbon buildup in head. Engine was possibly run with choke in closed or partially closed position instead of open.	Ensure choke mechanism operates correctly. With the choke in the fully open position and the engine running, the choke plate at entrance of the carburetor should be fully open. On lever chokes move the lever all the way to the right Replace choke mechanism if choke does not operate in this way or is damaged. Test and verify compression is correct. Refer to <b>Compression Test</b> under <i>Perform Test Checks</i> .
	7. Internal part failure	With spark plug removed, rotate engine shaft by hand to see if it rotates smoothly. If still locked up, remove crankcase cover and determine cause.
Poor performance, low power, running too fast, Backfiring often	1. Fuel quality issue or restriction	Refer to <b>Engine will not start, stay running or only runs when choked</b> steps 5,6,12 & 13 under <b>Starting Problem/Engine</b> under <i>Troubleshooting</i> .

PROBLEM	POSSIBLE CAUSE	SOLUTION
Poor performance, low power, running too fast, Backfiring often (continued)	2. Spark arrestor dirty or clogged	Clean spark arrestor, refer to <b>Spark Arrestor</b> under <i>Maintenance</i> . Run engine briefly without spark arrestor to verify that was the cause. Reassemble spark arrestor to muffler. If screen is damaged replace spark arrestor if screen is damaged. <b>IMPORTANT:</b> These products are equipped with spark-arresting mufflers. It is legally required in the state of California. It is a violation of California statutes section 130050 and/or sections 4442 and 4443 of the California Public Resources Code, unless the engine is equipped with a spark arrester, as defined in section 4442, and maintained in effective working order. Spark arresters are also required on some U.S. Forest Service land and may also be legally required under other statutes and ordinances.
	3. Worn governor arm rivet joint Worn carburetor throttle actuator, Governor arm slipping on shaft, Throttle linkages bent High speed screw has been tampered with	If engine is running over 4000 rpm (67Hz), first ensure all linkages controlling the throttle position actuate freely without binding over full travel. <b>NOTE:</b> Comparing the old governor linkage to a new replacement governor linkage may help to determine if the components in the system are worn or damaged. <ul style="list-style-type: none"> <li>The riveted joint in governor arm must pivot freely but not be loose and sloppy.</li> <li>If the high speed adjusting screw has been tampered with it can be readjusted, refer to <b>Speed/Governor Adjustments</b> under <i>Perform Test Checks</i>. HOWEVER, if the root cause of the high speed is due to the governor arm slipping on the governor shaft, adjusting the speed will give a false indication of being correct. The speed will be ok until put under a load, the engine will droop or bog down. After adjusting the speed, the unit must be tested using a load bank tester by gradually applying full rated load. If speed drops more than 3 Hz, the governor arm has slipped on the shaft and needs to be reset. To reset governor arm, refer to <b>Speed/Governor Adjustments</b> under <i>Perform Test Checks</i>.</li> </ul>
	4. Backfiring often or air filter melted, Ignition coil could be faulty	Replace ignition coil. <b>NOTE:</b> Coil resistance can measure ok and still be faulty. It is best to replace coil in this case.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Engine surges, hunts or runs unevenly	Fuel level too low, running out of gas can cause speed variation (hunting) for a while before engine quits	Check fuel level, add fuel if needed.
	Fuel quality issue or restriction	Refer to <b>Engine will not start, stay running or only runs when choked</b> steps 5,6,12 & 13 under <b>Starting Problem/Engine</b> under <i>Troubleshooting</i> .
	Spark arrestor dirty or clogged	Clean spark arrestor, refer to <b>Spark Arrestor</b> under <i>Maintenance</i> . Run engine briefly without spark arrestor to verify that was the cause. Reassemble spark arrestor to muffler. If screen is damaged replace spark arrestor if screen is damaged. <b>IMPORTANT:</b> These products are equipped with spark-arresting mufflers. It is legally required in the state of California. It is a violation of California statutes section 130050 and/or sections 4442 and 4443 of the California Public Resources Code, unless the engine is equipped with a spark arrestor, as defined in section 4442, and maintained in effective working order. Spark arresters are also required on some U.S. Forest Service land and may also be legally required under other statutes and ordinances.
	Stretched or missing governor spring (small)	Replace spring, refer to <b>Governor Linkage</b> under <i>Breakdowns</i> .
	Governor spring (large) is connected to wrong hole in governor arm	Try different connection holes in governor arm. Refer to <b>Governor Linkage</b> under <i>Breakdowns</i> .
Gas leaks	Gas is leaking from fuel valve	Fuel valve may be loose, tighten securing nut while holding valve in proper orientation. If valve still leaks, valve may be faulty, replace.
	Gas is leaking from fuel line	Ensure there are no splits or wear marks on gas line and ends are securely attached to fittings.
	Gas is leaking from carburetor the float needle may be stuck open	Remove float bowl and clean thoroughly. Remove float needle and clean needle and bore where it locates. Reassemble and check. If still leaks, replace carburetor. Refer to <b>Carburetor</b> under <i>Breakdowns</i> .
	Carburetor floods while transporting	Fuel valve must always be placed into the OFF position when transporting.
	Gas cap leaks when transporting	Gas should not be above shoulders of debris screen, refer to engine instruction manual) Non-California engines are equipped with vented caps, a small amount of gas will leak if unit is tipped at a steep angle and held there. If a large amount of gas leaks, ensure the rubber gasket under cap is present and the mating surface of the tank is smooth and flat. If >0.1 mm feeler gauge can fit under straight edge at any point, replace tank.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Gas leaks (continued)	Gas leaks when removing gas cap and pressure can be heard escaping as cap is removed (non-California engines only)	Gas cap is not venting properly. Replace gas cap.
High oil consumption and/or oil dripping from air cleaner or spark plug fouled with carbon	Breather valve missing or damaged	Remove cylinder head cover and look for disc valve just inside of breather hose. This disc must be free to open or close off opening. If stuck in one position or completely missing, replace cylinder head cover assembly.

#### PERFORMANCE PROBLEM

PROBLEM	CHECK	RESULT	SOLUTION
Engine: Lacks power Overheats Surges or runs unevenly Vibration or noise level is excessive	Test spark plug firing	No spark	See <b>Ignition Test</b> .
		Sparks inconsistently	See <b>Speed/Governor Adjustment</b> .
	Examine spark plug condition	Spark plug is dry	See <i>Carburetor/fuel delivery troubleshooting</i> .
		Spark plug is wet:	Check compression
	Compression	Poor compression	See <b>Compression Test</b> .
		Good Compression	Check fuel condition
	Check fuel condition	Poor fuel	See <b>Fuel System</b> under <i>Maintenance</i> .
		Adequate Fuel	See <b>Oil Alert Test</b> .

#### Starter/Battery

##### RECOIL STARTER

PROBLEM	CAUSE	SOLUTION
Engine does not turn over correctly	Starter cord cut	Disassemble and replace starter cord
	Return spring broken	Replace or realign return spring.
	Ratchet assembly malfunctioning	Replace ratchet

PROBLEM	CAUSE	SOLUTION
	Debris is locking up flywheel	Disassemble and clear any debris from recoil base and recoil assembly. See <b>Flywheel Ignition</b> under <i>Breakdown</i> .

#### BATTERY STARTER/BATTERY FAILURE

PROBLEM	CAUSE	SOLUTION
Battery does not supply electricity to starter	Battery leads faulty	Check for debris blocking connections If worn, replace battery
	Battery is dead	Charge and replace battery pack.

#### BATTERY STARTER/STARTER MOTOR FAILURE

PROBLEM	CAUSE	SOLUTION
Starter motor fails	Pinion gear not engaged with flywheel	Remove starter motor and make sure the pinion gear slides freely on helix
	Solenoid faulty	Make sure gear teeth have not been stripped
	Starter motor damaged	Repair or replace starter motor
Electrical relay fails	Starter toggle switch faulty	Check for continuity on starter toggle switch in the ON position. See Fan Cover breakdown section.

## Compression

#### STARTING PROBLEM

PROBLEM	CAUSE	SOLUTION
Poor compression	Leaking/stuck valves	Valve job/replacement
	Head gasket burned	Replace head gasket
	Worn piston rings	Service/replace rings or piston or crankcase
	Worn cylinder bore	See <b>Compression Test</b> .
	Warped/cracked cylinder head	Replace cylinder head

#### PERFORMANCE PROBLEM

PROBLEM	CAUSE	SOLUTION
Engine overheats	Cooling fins obstructed	Clear fins of debris
	Excessive load	Clean combustion chamber
	Carbon in combustion chamber	Clean combustion chamber
	Low oil	Add oil
	Set at wrong idle speed	See <b>Speed/Governor Adjustment</b> under <i>Perform Test Checks</i> .
Low power	Clogged spark arrestor	Remove, clean and replace.
	Valves leaking	Perform valve job, see <b>Inspection</b> under <i>Breakdowns: Cylinder Head Valves</i> .
	Intake exhaust manifolds clogged	Clean manifolds
	Carbon build up	Clean combustion chamber
Black exhaust smoke	Carbon in combustion chamber	Clean combustion chamber
	Valves leaking/stuck	Check valves/seats. Recondition if necessary. Check valve to valve guide fit up.
Blue exhaust smoke	Piston rings/cylinder bore worn and passing oil	Replace rings and piston/hone cylinder/check air filter.
Can not handle load	Improper valve clearance	Check/adjust valve clearance or perform valve job, see <b>Inspection</b> under <i>Cylinder Head Valves Breakdowns</i> .
	Weak valve spring	Perform valve job, see <b>Inspection</b> under <i>Cylinder Head Valves Breakdown</i> .
	Valve/valve seats worn or damaged	Perform valve job, see <b>Inspection</b> under <i>Cylinder Head Valves Breakdown</i> .



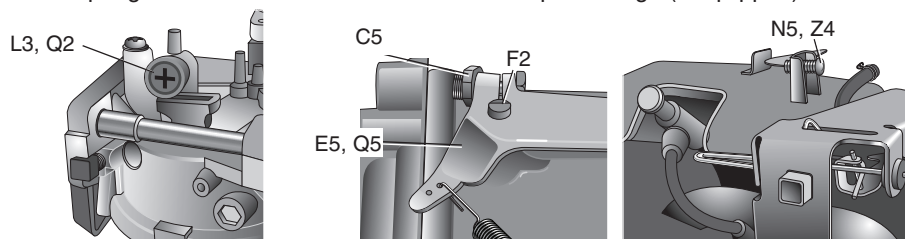
PROBLEM	CAUSE	SOLUTION
Excessive vibration/ knocking	Loose/worn connecting rod	Repair connecting rod
	Carbon in combustion chamber	Clean carbon from chamber
	Bent crankshaft	Disassemble crankcase and repair
	Engine mount damaged	Check engine mounting bolts or replace rubber isolator
	Timing out	Check flywheel key

## Perform Test Checks

### SPEED/GOVERNOR ADJUSTMENT

If speeds are out of adjustment use this procedure to reset to factory settings.

- Back off both idle adjustment screws far enough so they are out of the way.  
**NOTE:** This is the black plastic screw (L3, Q2) at carburetor and the screw with the black spring under the head on the solenoid L-shaped linkage (if equipped).



- Loosen the governor arm (E5, Q5) from the shaft (F2) coming out of the top of engine.

#### On 9 and 13 HP engines:

Rotate the shaft **counterclockwise** with the governor arm held to the right at WOT (wide open throttle). Make sure governor arm remains straight and does not pivot at the joint in the middle (if equipped). Retighten governor arm to shaft in this extreme position.

#### On 6.5 HP engines:

Rotate the shaft **clockwise** with the governor arm held to the right at WOT (wide open throttle). Retighten governor arm to shaft in this extreme position.

- Governor spring (large silver) should be in the hole on the governor arm closest to the shaft.
- Back out high speed adjustment screw (N5, Z4) on top of the engine at the small silver lever. A few complete turns will do.
- Start the engine. If it hunts (speed varies up and down.), move the governor spring to the outer hole, if power is too low move it back in toward the shaft. **NOTE:** Hunting is unpredictable and sometimes the opposite movement of the spring helps.
- Engine will probably be running slow. Adjust high speed to 3600 rpm by turning high speed screw (N5, Z4) on top, in to increase speed and out to slow down. If engine still runs to fast, governor arm may still be out of adjustment on shaft or it has moved since tightening. Or there could be an internal governor issue (this is rare).

**NOTE:** If governor arm was over tightened to shaft and has no gap at the end of the arm next to the shaft, over tightening of the governor arm will not result in sufficient holding force to shaft. The governor arm must be replaced.

- With engine off, ensure idle linkages on solenoid are not binding and are free to move the full travel. Also make sure throttle linkage from carburetor to governor arm moves back and forth freely.

- Ensure the idle screw (with black spring under the head on the L-shaped lever on the solenoid) is backed out far enough to just clear touching the governor arm with idle control turned off.
- Start the engine. Turn idle control on after engine has warmed up some. Solenoid should push governor arm and throttle to the left toward carburetor and the black plastic throttle should stop up against black plastic screw (L3, Q2). Adjust the idle speed to 2700–2800 RPM by adjusting this screw in to increase idle speed, back it out to reduce. If solenoid does not push lever over far enough to touch black plastic screw (the screw with the black spring on the L-shaped solenoid lever) can be turned in to make this happen. Both of these screws can be adjusted in or out so one is not at the extreme of it's adjustment length.
- Cycle idle control switch on and off a few times and check both high speed and idle speed to ensure they are still correct.

### IGNITION TEST

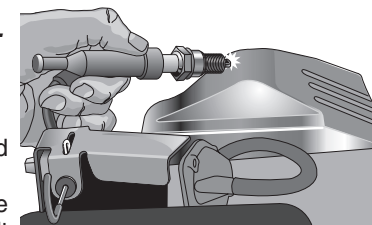
#### CHECK FOR SPARK

**⚠ WARNING: Risk of explosion.** Spilled gasoline and it's vapors can become ignited from sparks from smoking products, electrical arcing, exhaust, flame, gases and hot engine components such as the muffler. Make sure there are no sources of ignition, such as smoking products near servicing location. Wipe any fuel spillage from engine.

#### ⚠ WARNING:

- Never hold the spark plug wire with wet hands while performing test.
- Wipe any fuel spillage from engine.
- Make sure the spark plug is not wet with fuel.
- Do not allow sparks near the plug hole.

- Remove the spark plug from the cylinder head.
- Ground spark plug against air shroud as shown.
- Place the on/off switch in the "ON" position and crank the engine.
- Check to see if the spark bridges the electrode gap. If you can see the spark (this may be difficult in bright daylight) the problem is most likely not the ignition system. If spark plug fails to spark, see **Flywheel Ignition Inspection**.



### OIL ALERT TEST

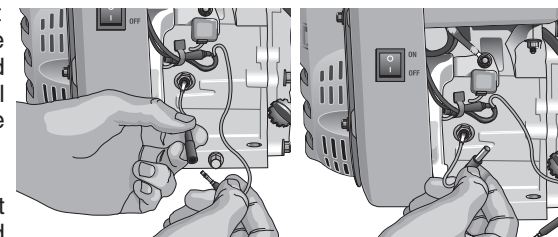
**Perform this check if the engine will not start and other troubleshooting attempts have failed. Ensure oil is a proper level, see Oil under Maintenance.**

#### Engine will not start:

Disconnect the lead from the oil alert sensor and directly connect the leads from the ignition switch and the ignition bypassing the low oil sensor. If the engine starts replace the sensor.

#### Engine will not stop:

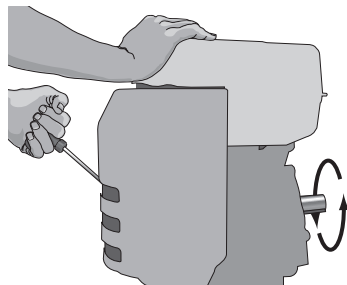
With the engine running disconnect the oil alert sensor lead and ground it against the engine. If the engine does not stop replace the sensor.



## START MECHANISM

**⚠WARNING: Risk of explosion.** Spilled gasoline and its vapors can become ignited from sparks from smoking products, electrical arcing, exhaust, flame, gases and hot engine components such as the muffler. Make sure there are no sources of ignition, such as smoking products near servicing location. Wipe any fuel spillage from engine.

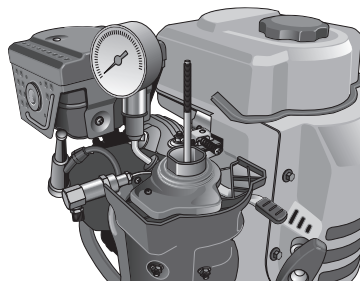
1. If the engine is equipped with a DEWALT battery starter, push the start control to START and check for crankshaft rotation. **NOTE:** Ensure a fully charged 18V DEWALT battery is being used.



- a. If the crankshaft does not rotate, pull the recoil start cord. If the crankshaft rotates the electric starter or connection to battery is faulty. Inspect and repair.
- b. If the battery start switch is engaged and the electric motor can be heard running the problem is with the drive pinion gear, service the starter motor. If the electric motor can not be heard running the problem is electrical. See the **Starter Motor Inspection** section.

## COMPRESSION TEST

1. Remove the spark plug and thread in compression gauge.
2. Use pull starter to simulate starting engine (pull briskly) or use fully charge battery pack if electric start. Compression gauge should read 40 psi min., if lower than 40 psi check valve clearance before proceeding further.
3. If valve clearance is in spec and compression is still low, check head gasket and then piston rings and cylinder bore for wear.



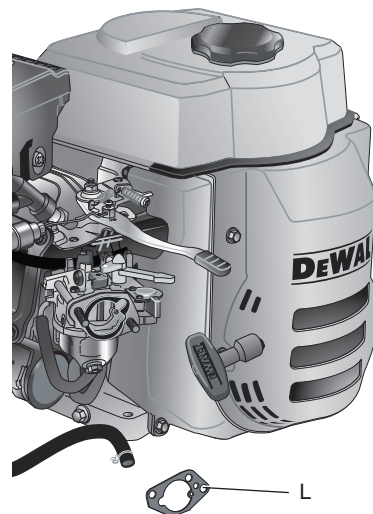
**HINT:** Only use a peak compression gauge when doing a compression test. Leak down testers can only measure decay with the piston at TDC.

## BREAKDOWNS

### Air Filter

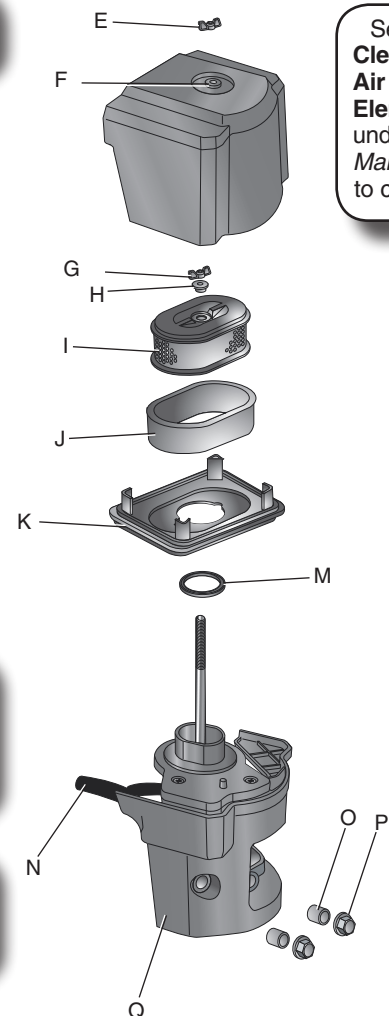
- E. Wingnut
- F. Air filter cover
- G. Wingnut
- H. Grommet
- I. Air filter element (paper)
- J. Air filter element (foam)
- K. Air filter element base
- L. Gasket
- M. O-ring
- N. Breather tube
- O. Sleeve (2)
- P. Intake manifold nut (2)
- Q. Air filter housing

**NOTE:** Hand tighten wingnuts (E, G).



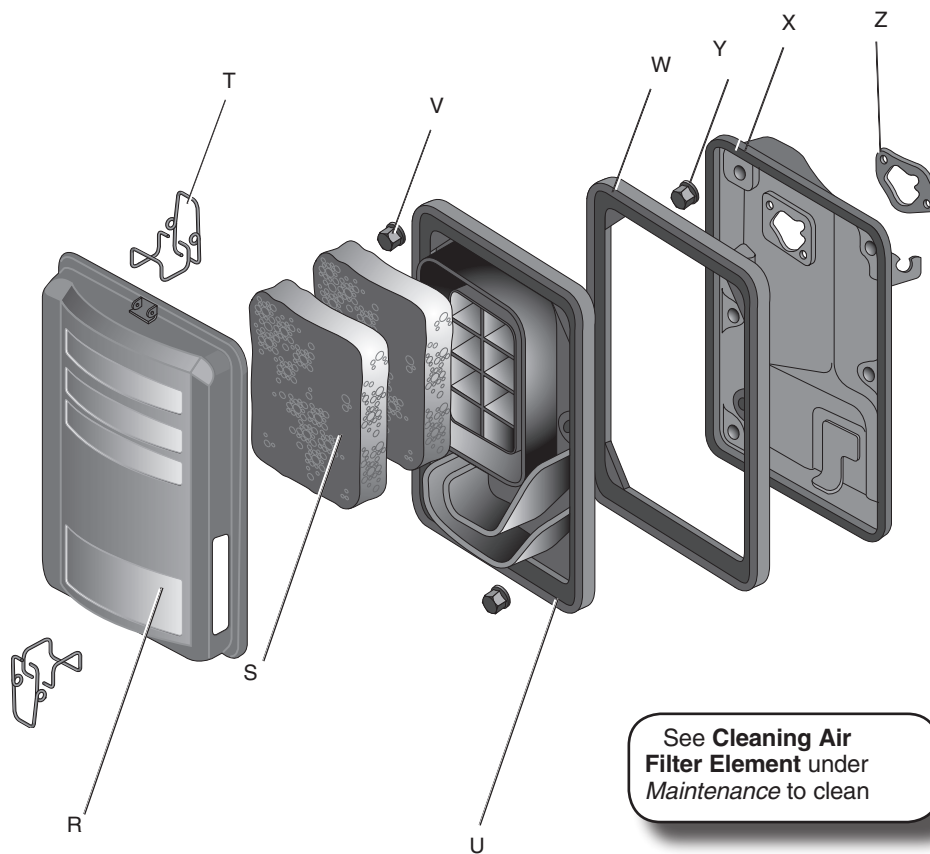
**NOTE:** When removing gasket (L) note the orientation for reinstallation. Check gasket (L) for damage, replace if needed.

**NOTE:** Insert breather tube (N) into valve head cover after installing onto air filter housing



## Air Cleaner

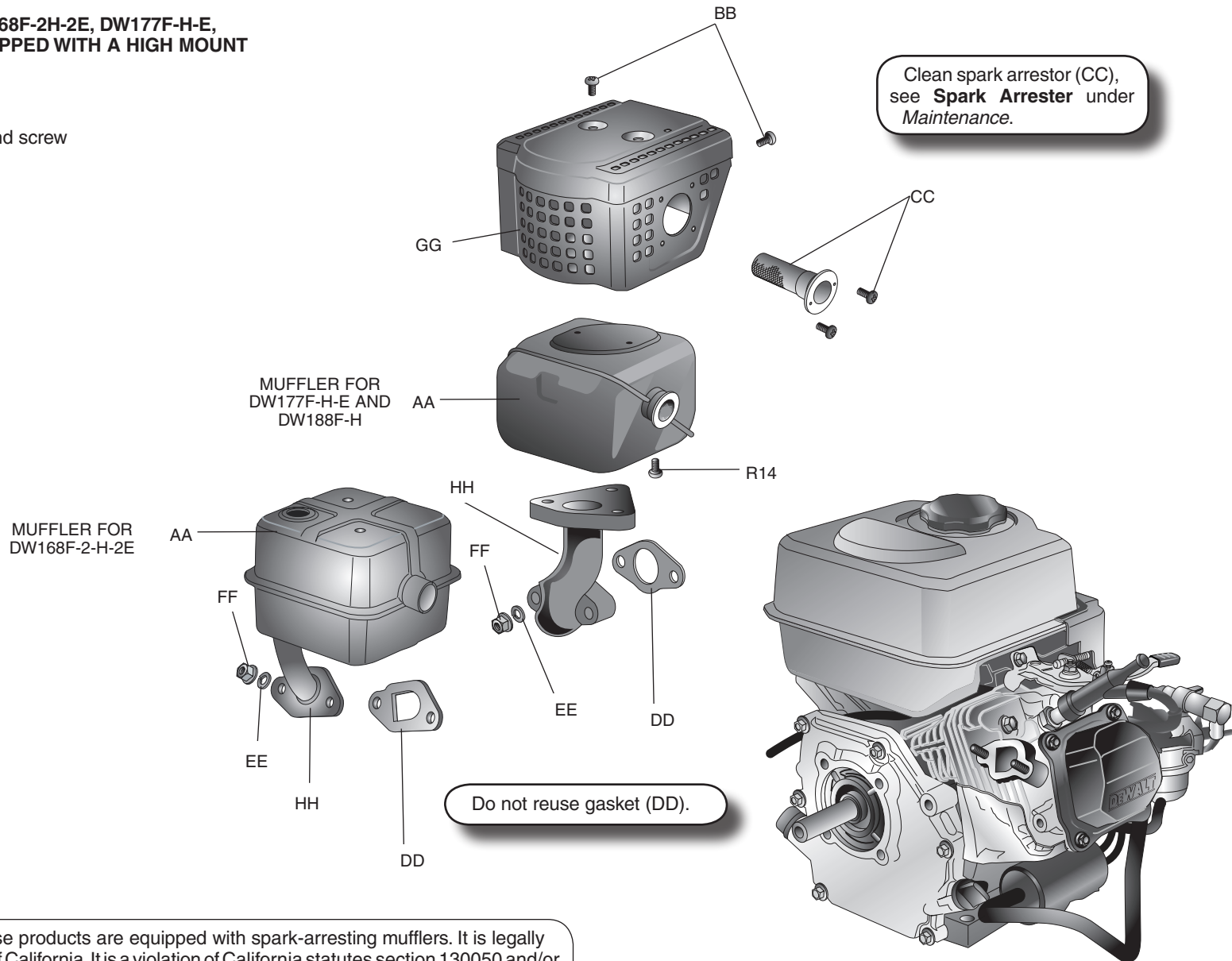
- R Air filter cover
- S Air filter element (one or two pieces of foam).
- T Snap Clip (2)
- U Flow control plate
- V Air cleaner nut (6)
- W Air cleaner gasket
- X Air cleaner base
- Y Intake manifold nut (2)
- Z Intake separator gasket



## Muffler

**NOTE: MODELS DW168F-2H-2E, DW177F-H-E, DW188F-H ARE EQUIPPED WITH A HIGH MOUNT MUFFLER**

- AA. Muffler
- BB. Screws (4)
- CC. Spark arrestor and screw
- DD. Gasket
- EE. Lockwashers (2)
- FF. Nuts (2)
- GG. Muffler cover
- HH. Muffler Elbow
- R14. Screws (3)

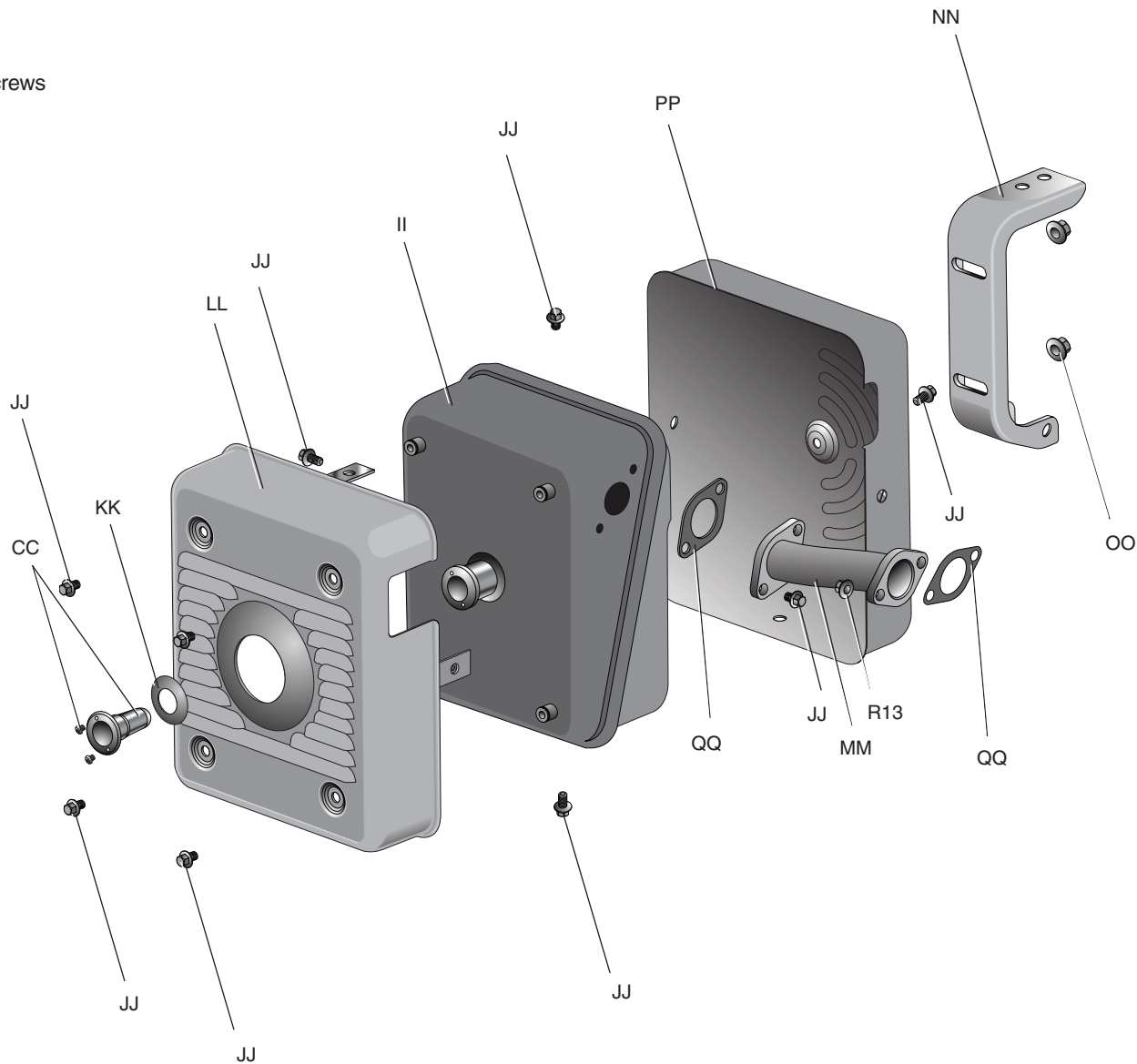


**IMPORTANT:** These products are equipped with spark-arresting mufflers. It is legally required in the state of California. It is a violation of California statutes section 130050 and/or sections 4442 and 4443 of the California Public Resources Code, unless the engine is equipped with a spark arrestor, as defined in section 4442, and maintained in effective working order. Spark arresters are also required on some U.S. Forest Service land and may also be legally required under other statutes and ordinances.

## Muffler

**NOTE: MODELS DW177FD-F, DW188F-F ARE EQUIPPED WITH A LOW MOUNT MUFFLER**

- II. Muffler
- JJ. Bolts (9)
- KK. Washer
- CC. Spark arrestor and screws
- LL. Muffler cover, front
- MM. Exhaust manifold
- NN. Muffler Bracket
- OO. Nuts (2)
- PP. Muffler cover, back
- QQ. Gasket (2)
- R13. Manifold nuts (2)



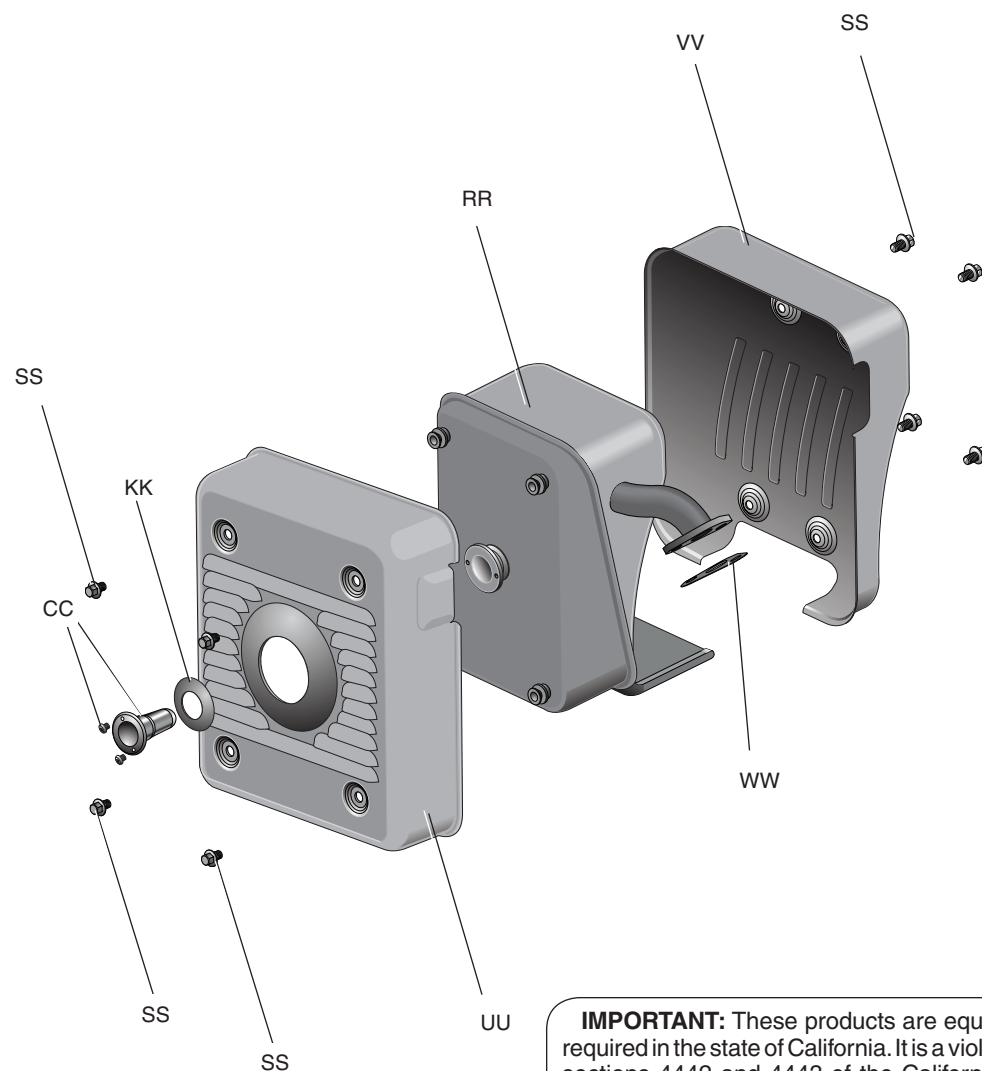
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## Muffler

NOTE: MODELS DW168F

### EQUIPPED WITH LOW MOUNT MUFFLER

KK. Washer  
RR. Muffler  
SS. Bolts (10)  
CC. Spark arrestor and screws  
UU. Muffler cover, front  
VV. Muffler cover, back  
WW. Gasket



**IMPORTANT:** These products are equipped with spark-arresting mufflers. It is legally required in the state of California. It is a violation of California statutes section 130050 and/or sections 4442 and 4443 of the California Public Resources Code, unless the engine is equipped with a spark arrester, as defined in section 4442, and maintained in effective working order. Spark arresters are also required on some U.S. Forest Service land and may also be legally required under other statutes and ordinances.



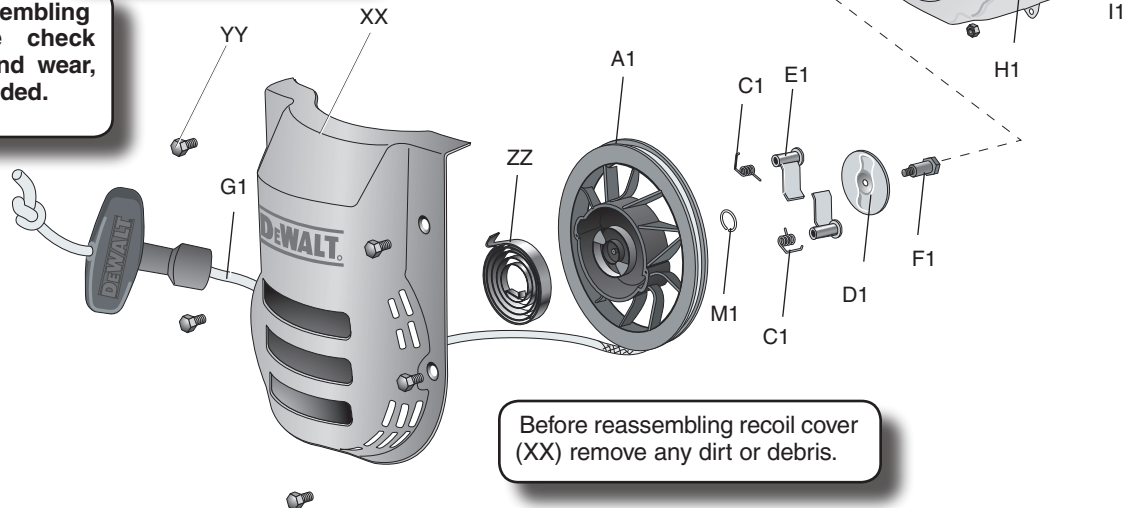
## Recoil Starter

- XX. Recoil cover
- YY. 8 mm screws (5)
- ZZ. Recoil starter spring
- A1. Starter reel
- B1. Studs (4)
- C1. Friction spring
- D1. Reel cover
- E1. Ratchet
- F1. Reel cover screw
- G1. Starter rope
- H1. Recoil Base
- I1. On/Off Switch  
(compressor and pressure washer)
- J1. Nuts (4)
- K1. Support bracket
- L1. Weather stripping
- M1. Snap ring

**⚠ WARNING:** Risk of unsafe operation. Always wear gloves and certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields when assembling and disassembling.

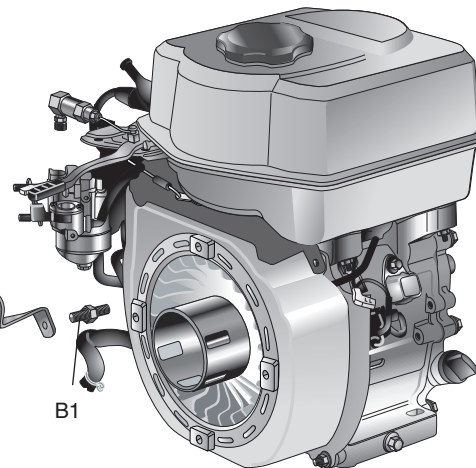
**CAUTION:** Risk of unsafe operation. Carefully remove starter reel (A1) from recoil cover (XX). Spring will unwind very quickly.

Before reassembling starter rope check for fraying and wear, replace if needed.



Before reassembling recoil cover (XX) remove any dirt or debris.

Before reassembling lubricate moving parts (C1, E1, F1) with bearing grease.



**NOTE:** Unhook the On/Off switch (I1) before removing the recoil base (H1).

Before reassembling check ratchets (E1) for wear, if needed replace.

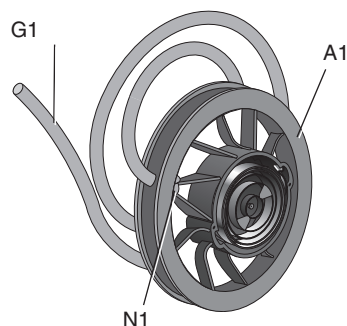


## Assemble Recoil Starter

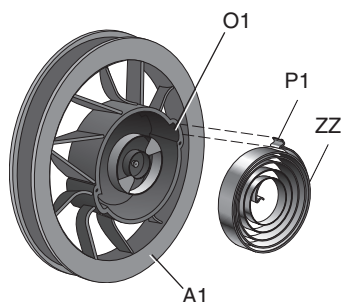
**⚠WARNING:** Risk of unsafe operation. Always wear gloves and certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields when assembling and disassembling.

1. Slide the starter rope (G1) through the starter reel (A1) and tie a knot (N1) in the rope as shown. Wind the starter rope around the starter reel in the direction of the arrow.

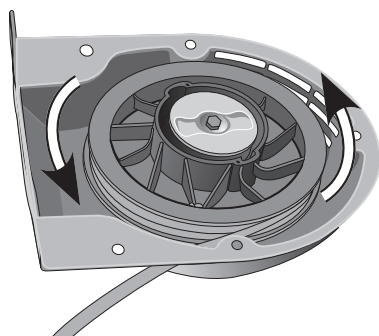
**NOTE:** Leave approximately 12" (30 cm) of starter rope outside the starter reel.



2. Place the hook (P1) on the outer side of the spring (ZZ) into the groove (O1) inside the starter reel (A1).

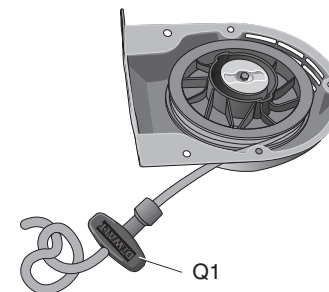


3. Place the starter reel on the recoil cover so the spring inner hook hooks to the case tab.
4. While holding the recoil cover, rotate the starter reel two revolutions in the direction of the arrows for preliminary winding.



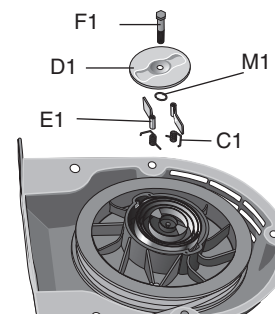
5. Slide the starter rope end through the recoil cover rope guide and pull it outwards. Pass the starter rope through the starter grip (Q1) and tie a knot in the rope as shown. **NOTE:** Rope will be under tension, clamp rope with vise or similar device to hold rope while tying.

**⚠WARNING:** Risk of unsafe operation. Do not separate the starter reel from the recoil cover. If they are separated the return spring inside the case will come off and could cause serious injury.



6. Install the ratchets (E1) with the friction springs (C1), snap ring (M1) and reel cover (D1). Tighten reel cover bolt (F1).

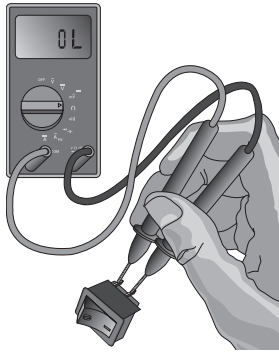
7. Pull the starter rope several times to check the operation of the ratchet. **NOTE:** Ratchet should extend outward while pulling starter rope and then retract.



## Inspection

### ON/OFF SWITCH

1. Remove switch from recoil base and detach leads from terminals.
2. Using an ohm meter measure the resistance between terminals 1 and 2 with the switch in the ON position (I). The ohm meter should read approximately infinity.
3. Using an ohm meter measure the resistance between terminals 1 and 2 with the switch in the OFF position (O). The ohm meter should read approximately zero.
4. If either of the tests described here yield a different result replace the switch.



## Carburetor

### DISASSEMBLY

- R1. Governor rod
- S1. Governor spring
- T1. Fuel line
- U1. Spark plug wire
- V1. Insulator plate (if equipped)
- W1. Carburetor gaskets (3)
- X1. Manifold gasket
- Y1. Choke lever
- Z1. Carburetor
- A2. Throttle lever
- B2. Carburetor bowl drain bolt
- C2. Air cleaner gasket

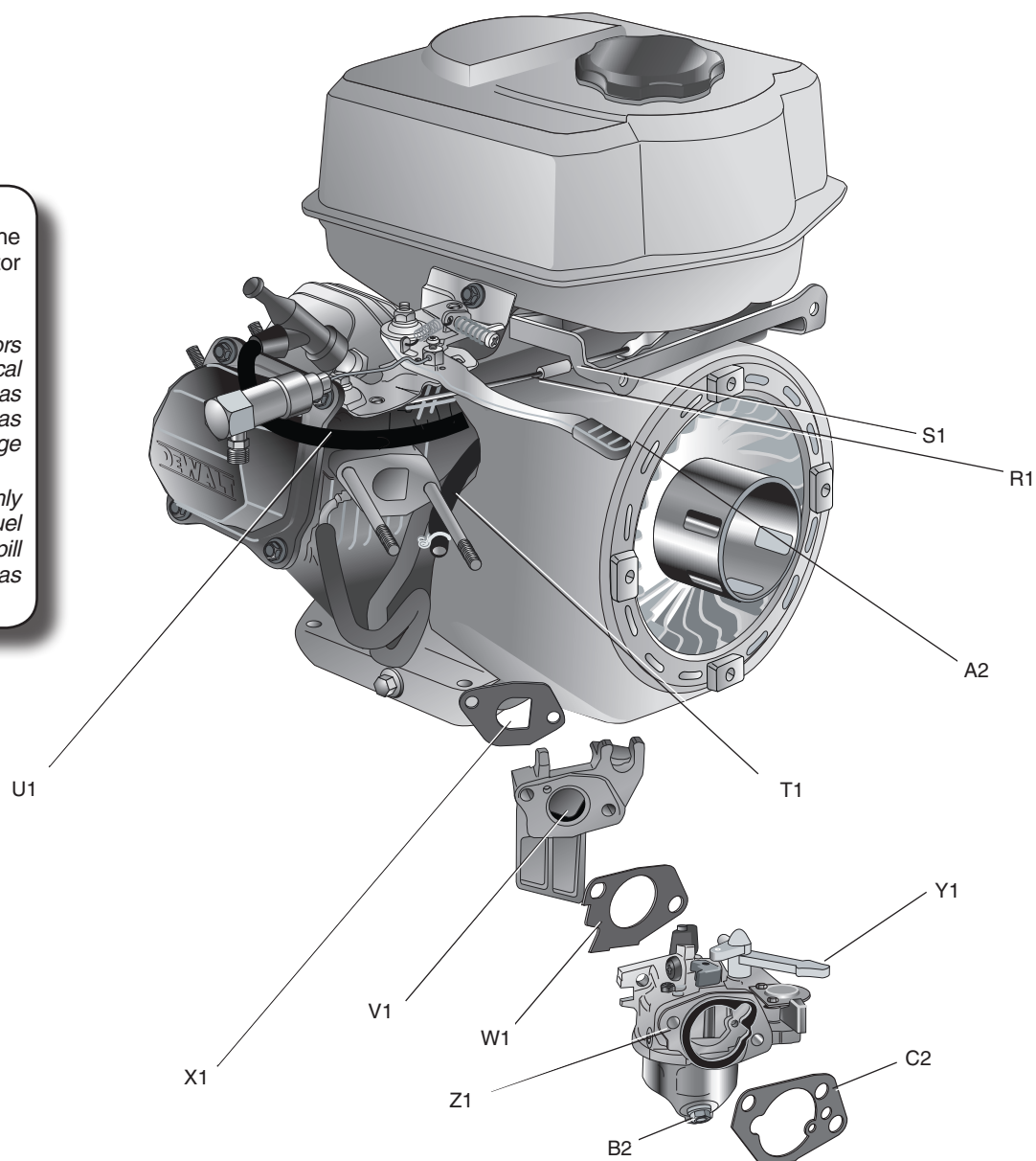
### BEFORE DISASSEMBLY:

- Drain gasoline from gas tank before removing. Loosen the carburetor bowl drain bolt (B2, F3, K2) and drain the carburetor and gas tank completely.
- Disconnect the governor spring (S1).

**⚠WARNING:** Risk of explosion. Spilled gasoline and its vapors can become ignited from sparks from smoking products, electrical arcing, exhaust, flame, gases and hot engine components such as the muffler. Make sure there are no sources of ignition, such as smoking products near servicing location. Wipe any fuel spillage from engine.

**⚠WARNING:** Risk of explosion or fire. Gasoline vapor is highly flammable. Refuel outdoors only in well-ventilated areas. Do not refuel or check gasoline level while the engine is running. Do not store, spill or use gasoline near an open flame, a source of sparks (such as welding), or near operating electrical equipment.

With the governor spring (S1) unhooked, pull the carburetor out until the groove in the throttle arm lines up with the governor rod and then lift the rod out. Assemble in reverse order.



## Carburetor

MODELS DW168F-2H, DW168F-2E,  
DW177F-H, DW177F-E, DW188F-H  
**ASSEMBLY**

D2. O-Ring  
E2. Fuel valve gasket  
G2. Lever spring  
H2. Fuel valve lever  
I2. Choke lever  
I4. Main jet  
J2. Carburetor bowl  
K2. Fuel drain bolt  
L2. Set bolt  
M2. Float pin

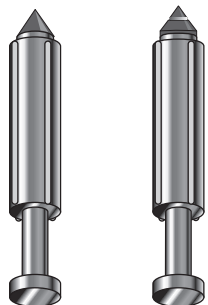
N2. Float valve spring  
O2. Float valve  
P2. Float  
Q2. Throttle stop screw  
R2. Pilot Jet  
S2. Throttle stop screw seat  
T2. Choke valve  
U2. Carburetor Body  
V2. Screw (2)  
W2. Lever setting plate  
X2. E-tube

Adjust throttle stop screw (Q2). See **Speed/  
Governor Adjustment** under *Maintenance*.

Check for smooth movement after  
installing the float. (P2).

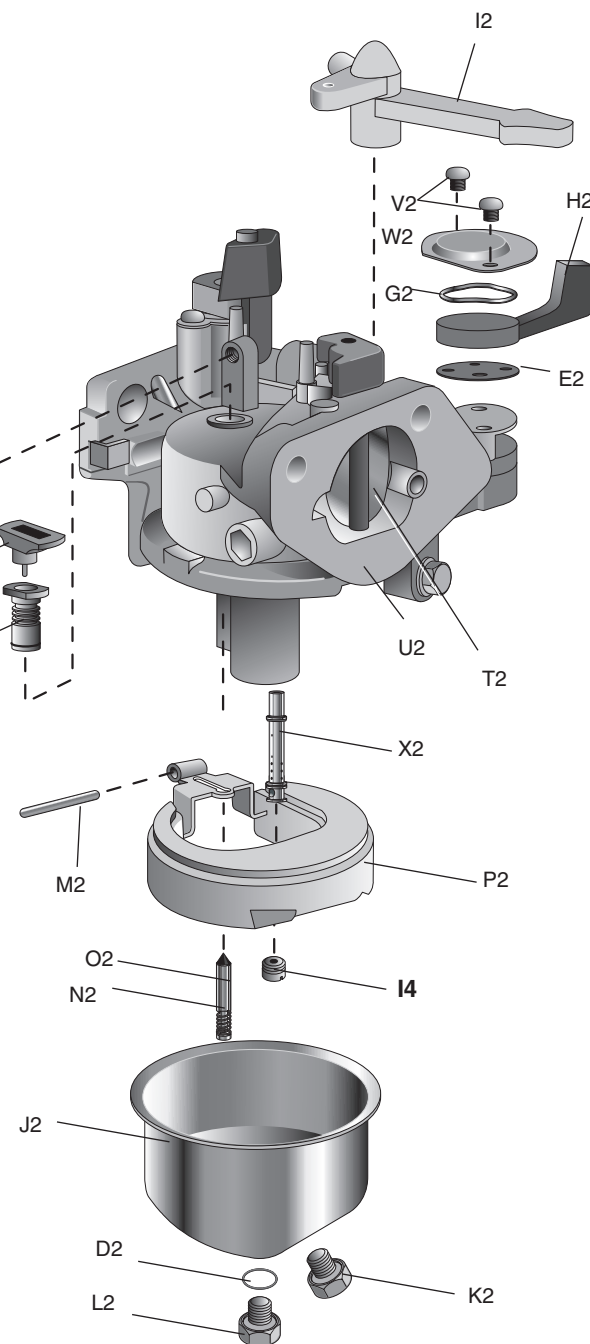
Clean carburetor body (U2).

OK REPLACE



Before reassembling  
float (P2), check float  
valve for wear and replace  
if needed.

After assembling set bolt  
(L2) and carburetor check for  
any signs of fuel leaking.

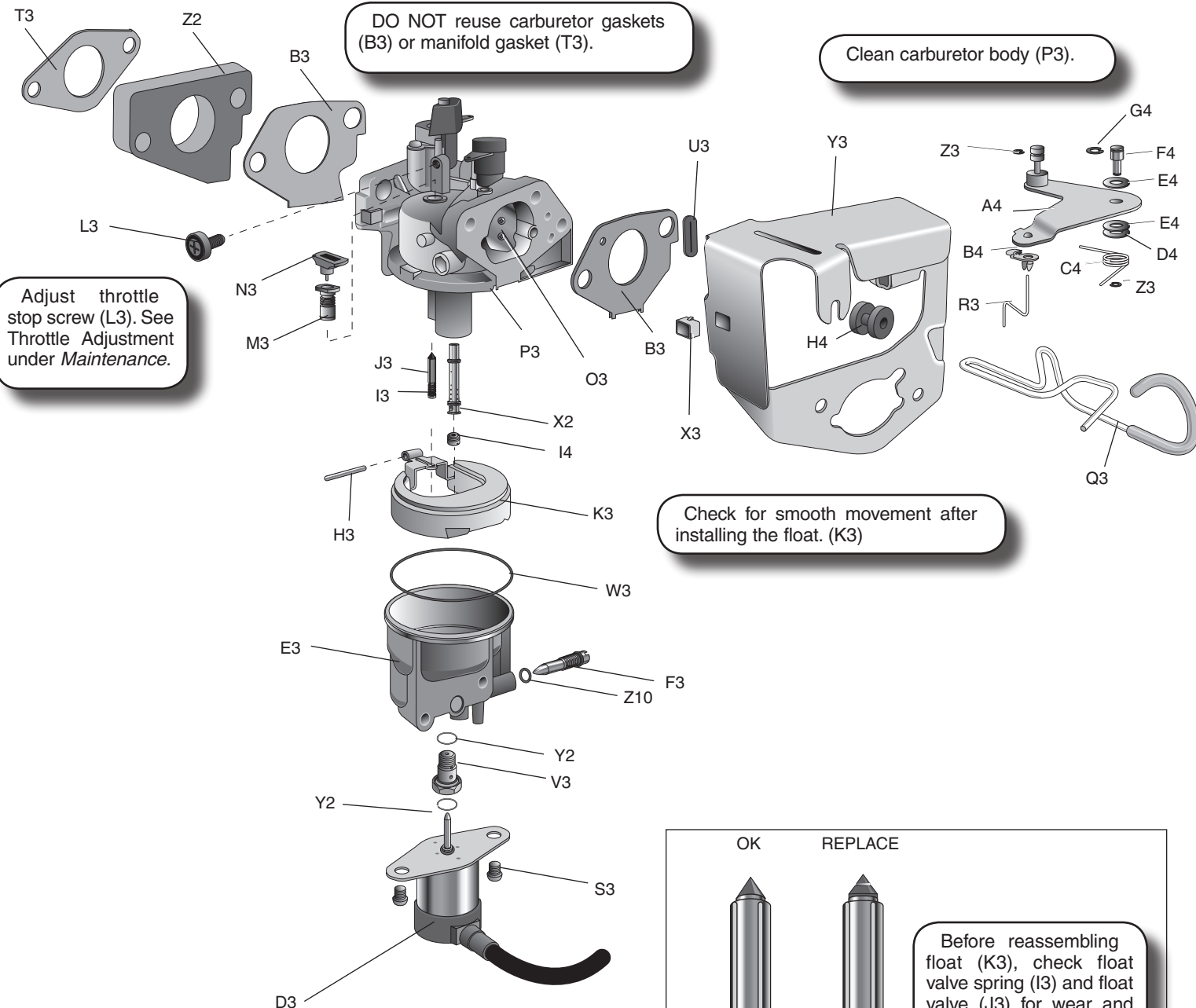


# Carburetor

MODELS DW177FD-F, DW188F1-F

## ASSEMBLY

- Y2. O-ring, fuel shut off
- Z2. Insulator Plate
- B3. Carburetor gaskets (2)
- D3. Valve assembly solenoid
- E3. Carburetor bowl
- F3. Fuel drain bolt
- H3. Float pin
- I3. Float valve spring
- J3. Float valve
- K3. Float
- L3. Throttle stop screw
- M3. Pilot Jet
- N3. Throttle stop screw seat
- O3. Choke valve
- P3. Carburetor Body
- Q3. Choke ring
- R3. Choke rod
- S3. Screw (2)
- T3. Gasket, manifold intake
- U3. Long grommet
- V3. Fuel shut off bolt
- W3. O-ring, carburetor bowl
- X3. Choke stopper
- Y3. Choke bracket
- Z3. E-ring (2)
- A4. Choke linkage
- B4. Choke guide
- C4. Return spring
- D4. Steel Washer
- E4. Wear guard (2)
- F4. Control post
- G4. E-ring
- H4. Choke Grommet
- I4. Main jet
- X2. E-tube
- Z10. O-ring, drain bolt



## Cleaning

**⚠WARNING:** Always wear certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields when using compressed air.

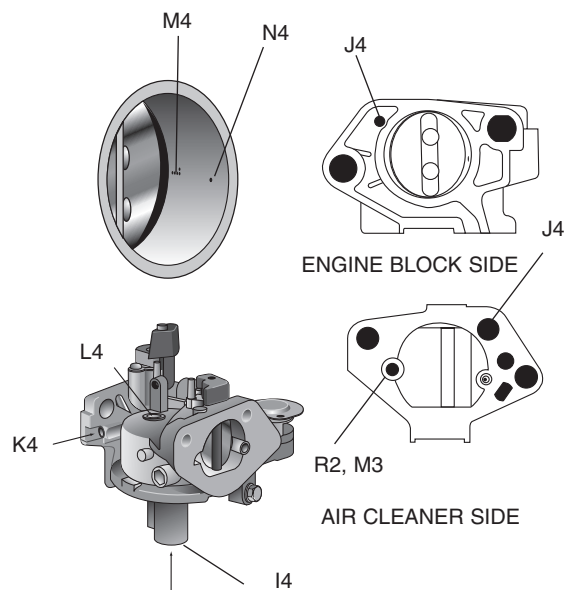
**CAUTION:** Commercially-available chemical cleaners are very caustic. These cleaners may damage plastic parts such as O-rings, floats and float valve seats. Check the container for instructions.

Do not use these products if in doubt.

**CAUTION:** Using high air pressure may cause damage to the carburetor; only use low air pressure settings when cleaning passages and ports.

### CARBURETOR

1. Clean the carburetor body with solvent.
2. Use low air pressure and clean the following parts and passages.
  - Internal or external vent port (J4)
  - Pilot screw hole (K4)
  - Pilot jet hole (L4)
  - Pilot air jet (R2, M3)
  - Main jet (I4)
  - Transition ports (M4)
  - Pilot outlet (N4)



## Gas Tank

MODELS DW168F-2H, DW168F-2E,  
DW177F-H, DW177F-E, DW188F-H

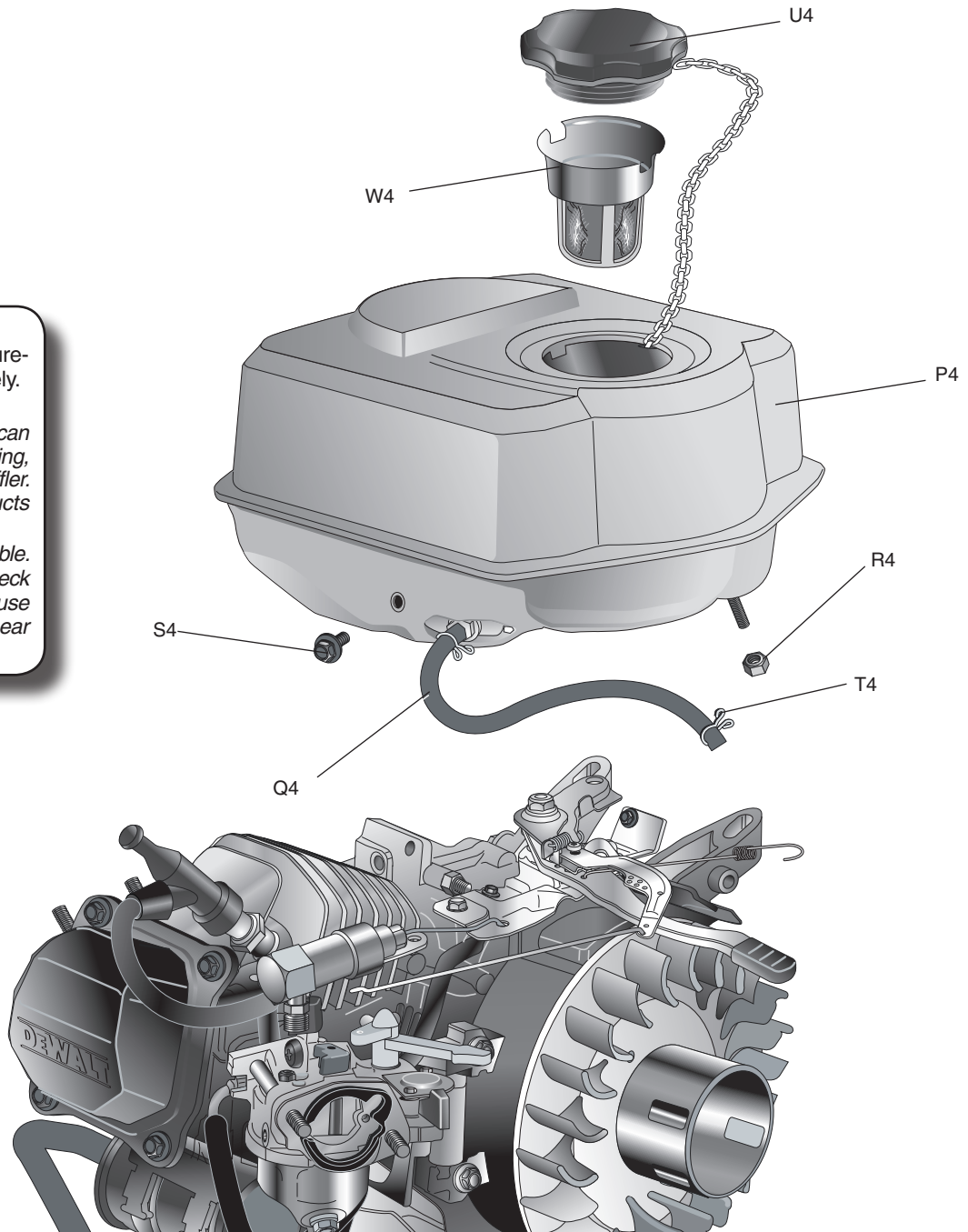
- P4. Gas tank
- Q4. Fuel line
- R4. Nuts (2)
- S4. Screw
- T4. Clamp (2)
- U4. Gas cap
- W4. Debris screen

### BEFORE DISASSEMBLY:

- Drain gasoline from gas tank before removing. Loosen the carburetor fuel drain bolt (B2, K2, F3) and drain the carburetor completely.
- Remove recoil starter cover, recoil base and weather stripping

**⚠WARNING: Risk of explosion.** Spilled gasoline and its vapors can become ignited from sparks from smoking products, electrical arcing, exhaust, flame, gases and hot engine components such as the muffler. Make sure there are no sources of ignition, such as smoking products near servicing location. Wipe any fuel spillage from engine.

**⚠WARNING: Risk of explosion or fire.** Gasoline vapor is highly flammable. Refuel outdoors only in well-ventilated areas. Do not refuel or check gasoline level while the engine is running. Do not store, spill or use gasoline near an open flame, a source of sparks (such as welding), or near operating electrical equipment.



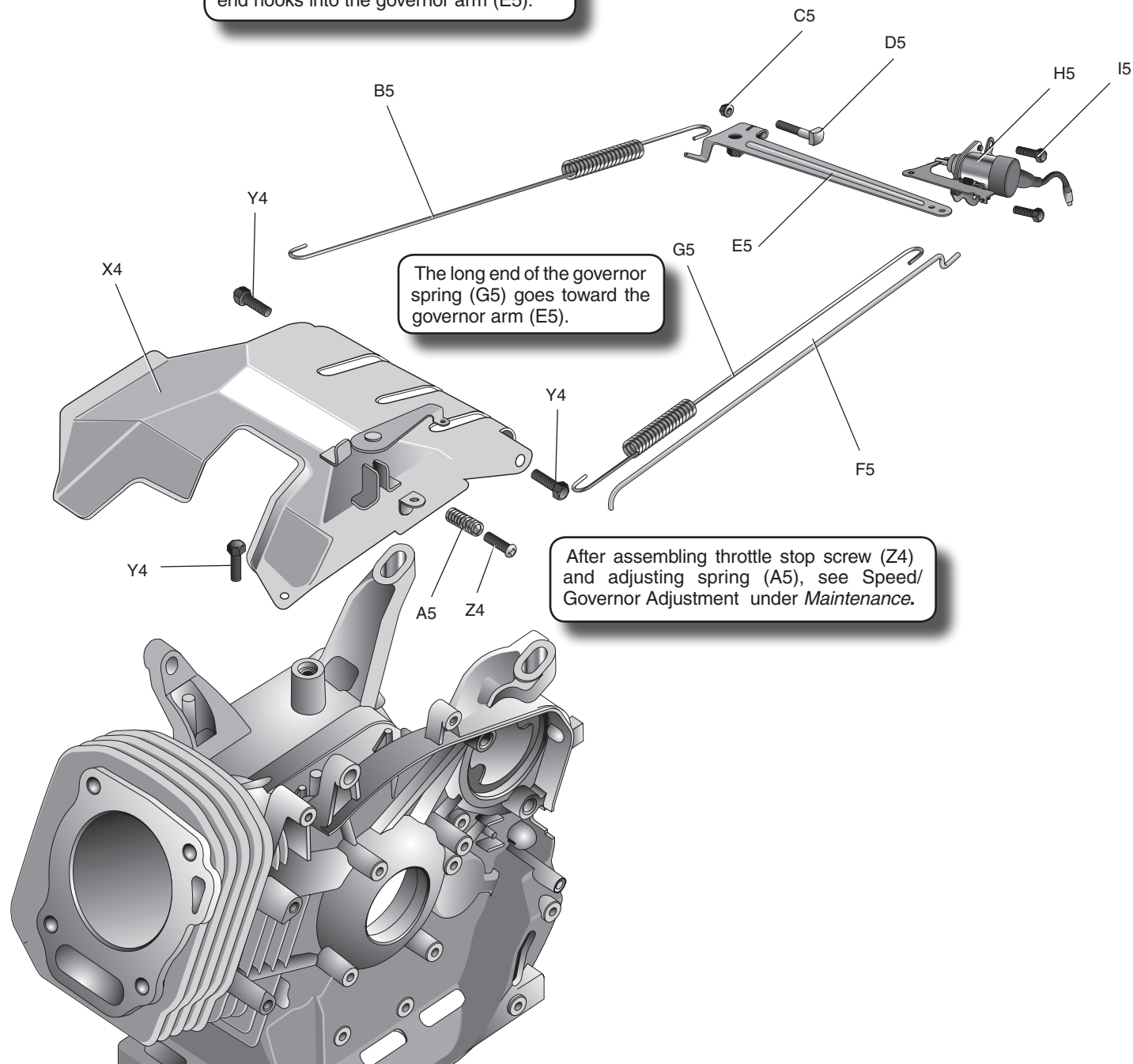


## Governor Linkage

MODELS DW168F-2F, DW177FD-F, DW188FD-F

- X4. Control base cover
- Y4. Shroud bolt (3)
- Z4. Throttle stop screw
- A5. Adjusting spring
- B5. Governor spring
- C5. Governor arm nut
- D5. Governor arm bolt
- E5. Governor arm
- F5. Governor rod
- G5. Governor spring
- H5. Idle control solenoid
- I5. Solenoid bolts (2)

The long end of the governor spring (B5) goes toward the control lever and the short end hooks into the governor arm (E5).





## Governor

MODELS DW168F-2H, DW168F-2E,  
DW177F-H, DW177F-E, DW188F-H

J5. Control lever washer

K5. Control lever spring

L5. Control lever

M5. Control base

N5. Throttle lever limiting screw

U5. Governor rod

P5. Lock nut

Q5. Governor arm

R5. Governor spring

S5. Washer

T5. Washer

O4. Throttle pneumatic solenoid  
(compressor only -E engines)

### BEFORE DISASSEMBLY:

- Drain gasoline from gas tank before removing. Loosen the carburetor fuel drain bolt (B2, K2, F3) and drain the carburetor completely.
- Remove recoil starter cover, recoil base and weather stripping.

**⚠WARNING: Risk of explosion.** Spilled gasoline and its vapors can become ignited from sparks from smoking products, electrical arcing, exhaust, flame, gases and hot engine components such as the muffler. Make sure there are no sources of ignition, such as smoking products near servicing location. Wipe any fuel spillage from engine.

**⚠WARNING: Risk of explosion or fire.** Gasoline vapor is highly flammable. Refuel outdoors only in well-ventilated areas. Do not refuel or check gasoline level while the engine is running. Do not store, spill or use gasoline near an open flame, a source of sparks (such as welding), or near operating electrical equipment.

Adjust the governor. See Throttle Adjustment under Maintenance.

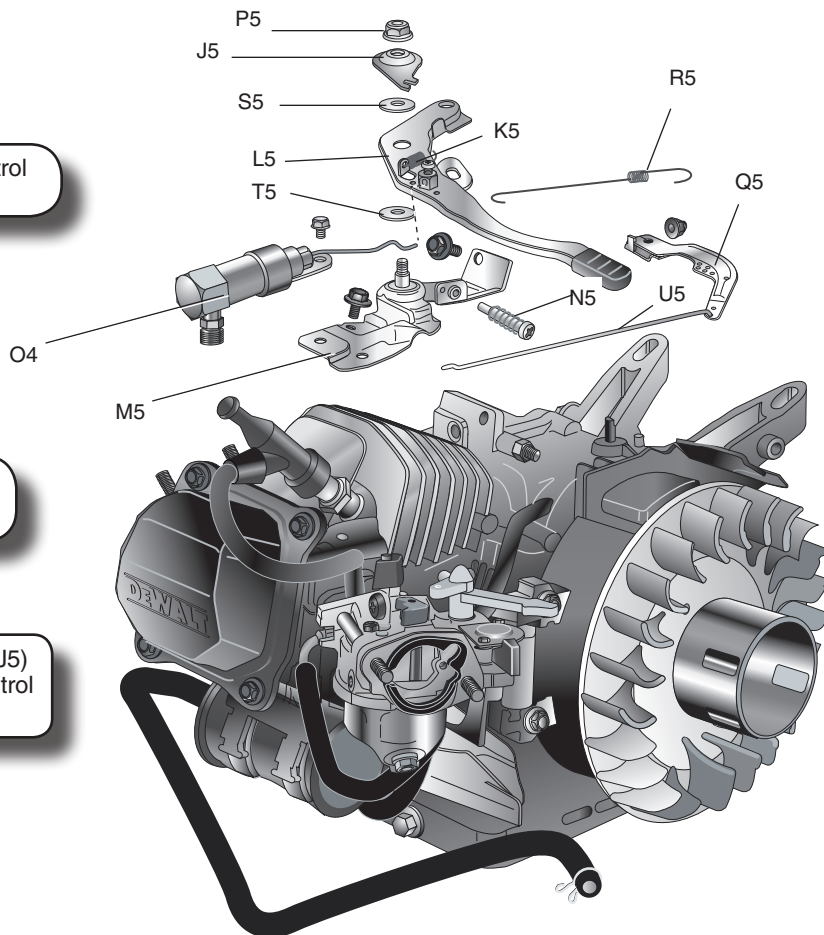
The long end of governor spring (R5) goes toward the control lever (L5) and the short end hooks into the outer hole of the governor arm (Q5).

Locknut (P5) adjusts the control lever friction.

The concave side of washer (S5) should be against the control lever.

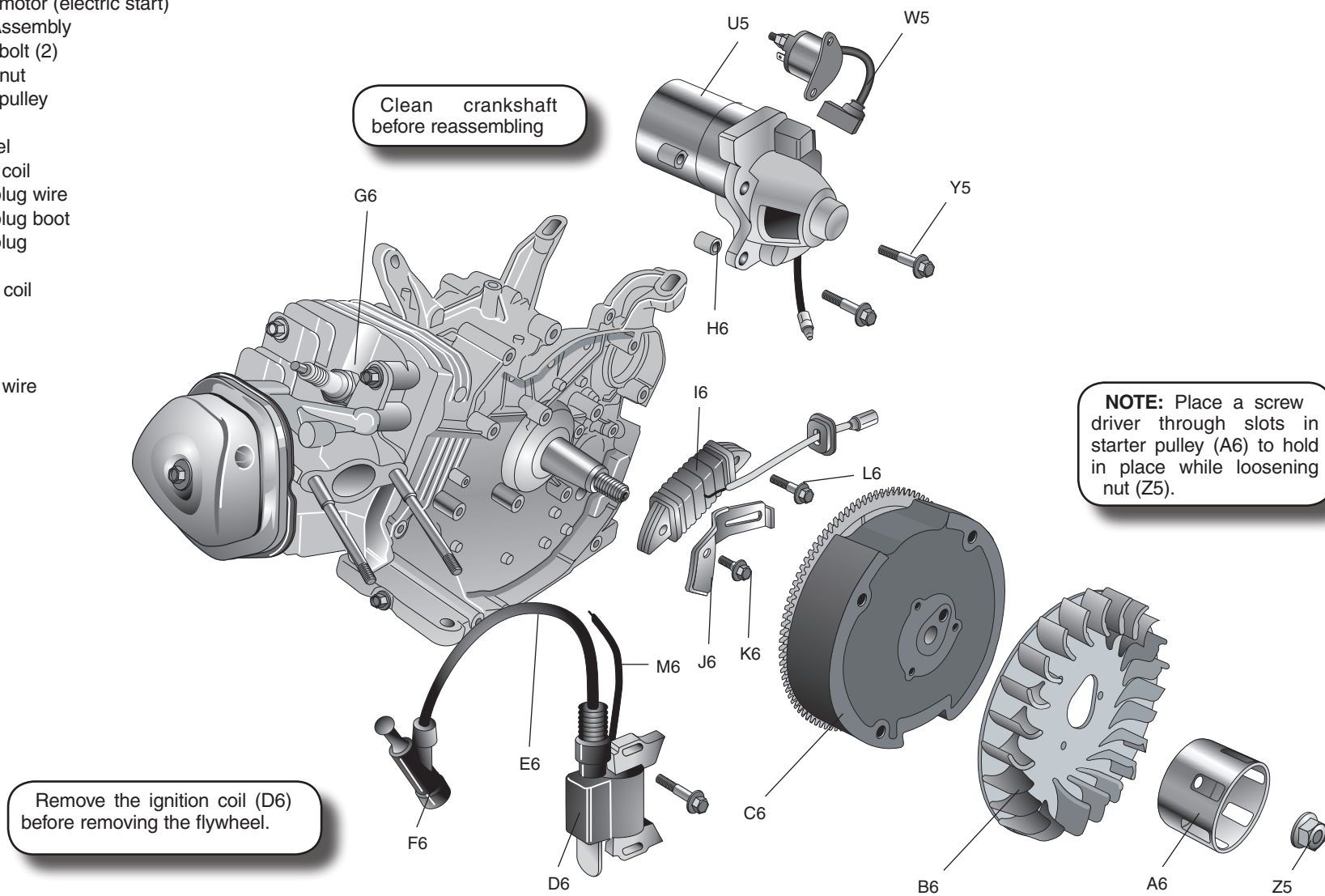
Align control lever washer (J5) groove with tab on the control base.

After assembling screw (N5), start the engine and adjust the maximum speed. See Throttle Adjustment under Maintenance.



## Flywheel Ignition

- U5 Starter motor (electric start)
- W5. Relay Assembly
- Y5. Starter bolt (2)
- Z5. Flange nut
- A6. Starter pulley
- B6. Fan
- C6. Flywheel
- D6. Ignition coil
- E6. Spark plug wire
- F6. Spark plug boot
- G6. Spark plug
- H6. Spacer
- I6. Charge coil
- J6. Bracket
- K6. Bolt
- L6. Bolt (2)
- M6. Ignition wire

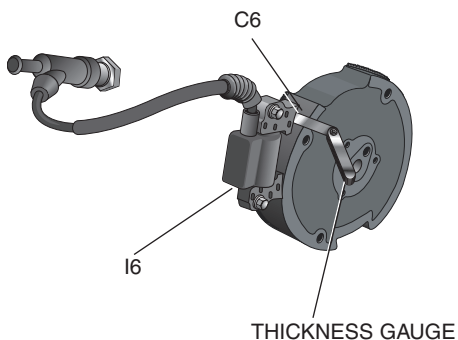


## Adjustment

### IGNITION COIL AIR GAP

Only required when ignition coil or flywheel has been removed.

1. Loosen the ignition coil bolts.
2. Insert a long thickness gauge or piece of paper of the proper thickness between the ignition coil (I6) and the flywheel (C6). **NOTE:** Both gaps should be adjusted simultaneously.
3. Push the ignition coil firmly toward the flywheel and tighten the bolts.



<b>SPECIFIED CLEARANCE</b>	0.3-0.5 mm (0.012-0.020")
----------------------------	------------------------------

4. Remove the thickness gauge.

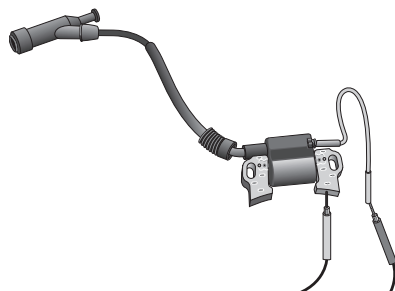
## Inspection

### IGNITION COIL

#### PRIMARY SIDE

Measure the resistance of the primary coil:

1. Attach one ohmmeter lead to the Ignition coil's primary (black) lead and Touch the other test lead to the iron core.

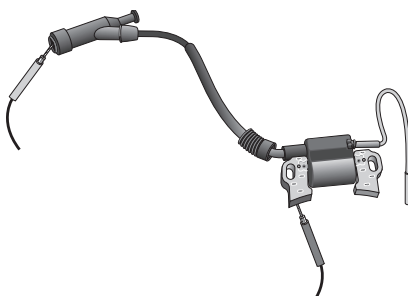


<b>PRIMARY SIDE RESISTANCE VALUE</b>	$1.3 \Omega \pm 0.2 \Omega$
--------------------------------------	-----------------------------

#### SECONDARY SIDE

Measure the resistance of the secondary coil:

1. Remove the spark plug boot from spark plug and touch one ohmmeter lead to the spark plug lead wire and the other test lead to the coil's iron core.



<b>SECONDARY SIDE RESISTANCE VALUE</b>	$6.4 \Omega \pm 1k \Omega$
--	----------------------------

**NOTE:** A false reading will result if the spark plug boot is not removed.

### SPARK PLUG BOOT

Measure the resistance of the spark plug boot.

1. Touch one ohmmeter lead to the wire end of the cap and the other at the spark plug (G6) end.

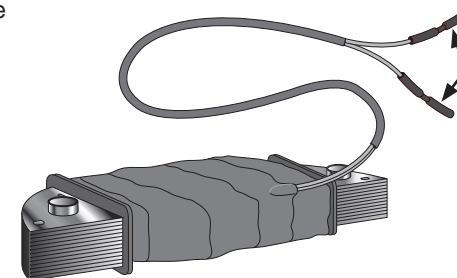
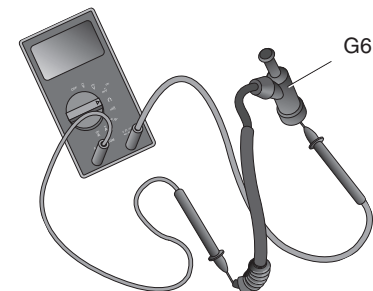
RESISTANCE STANDARD	SERVICE LIMIT
7.5k — 12.5k	<7.5k or >12.5k

**NOTE:** Replace the spark plug boot if the resistance is not within the range specified.

### LAMP COIL (IF EQUIPPED)

Measure the resistance between the wire terminals.

	RESISTANCE
12 V — 15 W	$0.75 \pm 0.1 \Omega$



## Starter Motor

DW177FD-F, DW188FD-F

- N6. Bolts (3)
- O6. O-ring
- P6. Commutator/Armature assembly
- Q6. Brush plate
- R6. Brush/terminal assembly
- S6. Pinion gear
- T6. Driver side housing
- U6. Reduction gear
- V6. Front bracket
- W6. Overrunning clutch
- X6. Starter solenoid
- Y6. Terminal screw
- Z6. Conductor wire
- A7. Screw
- B7. Washers (qty 3)
- C7. Nuts (qty 3)
- D7. Magnetic Can

To remove starter motor fan, the cover and flywheel must be removed.

Disconnect wires from power equipment.

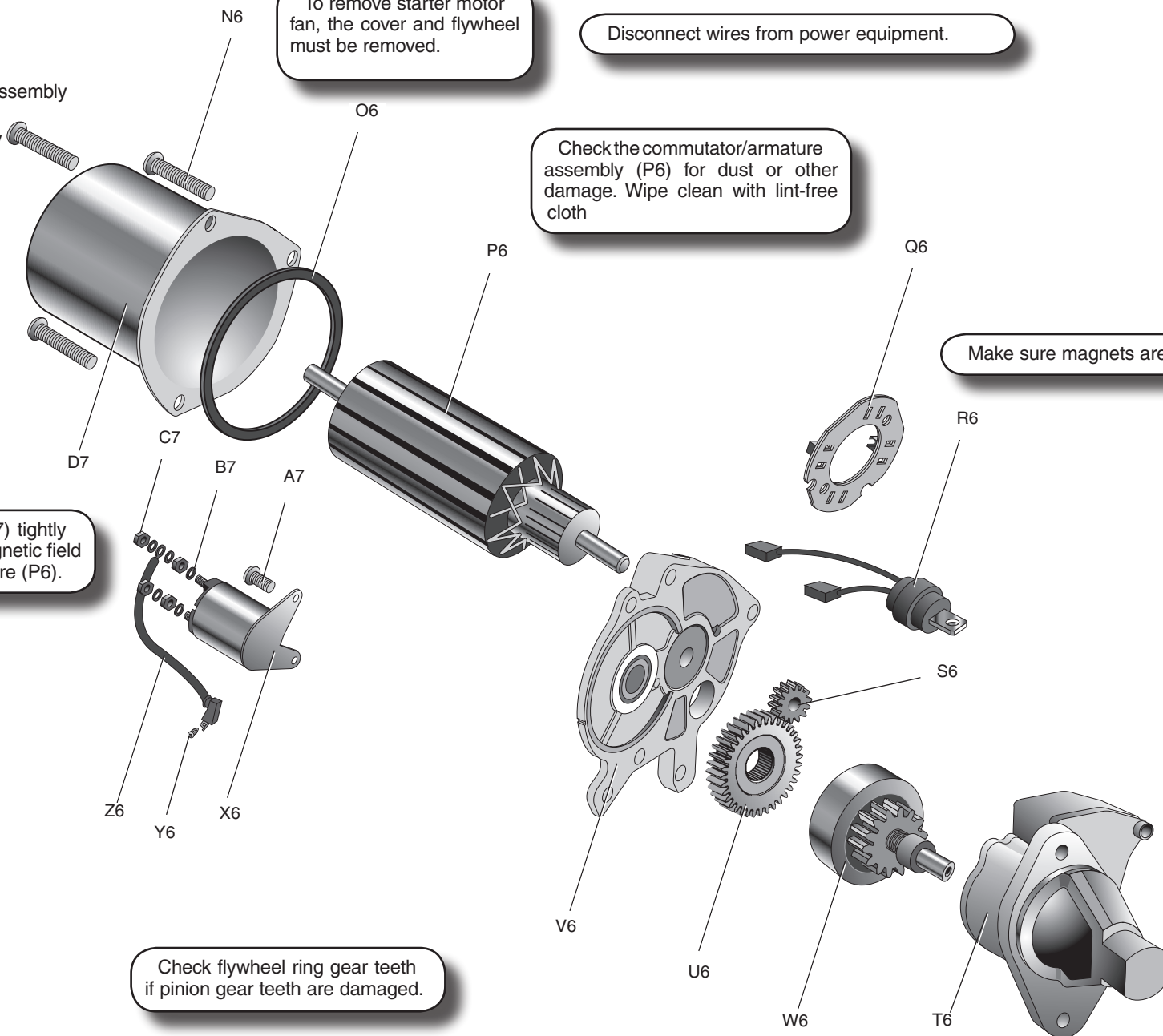
Check the commutator/armature assembly (P6) for dust or other damage. Wipe clean with lint-free cloth

Make sure magnets are clean

Hold magnetic can (D7) tightly when replacing, The magnetic field will pull can onto armature (P6).

Check flywheel ring gear teeth if pinion gear teeth are damaged.

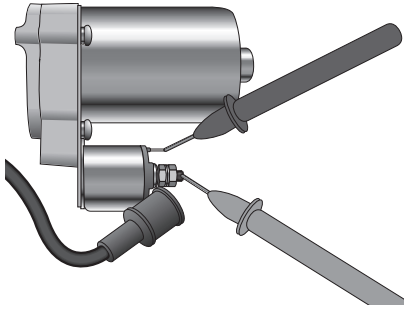
Make sure gears line up and commutator/armature assembly (P6) turns freely.



### STARTER SOLENOID

Connect a 12V battery between the starter terminal and the solenoid body and check for continuity between terminals.

**NOTE:** Continuity should exist when the battery is connected and not exist when the battery is disconnected.

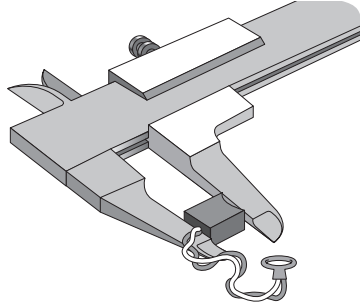


### BRUSH LENGTH

Measure the brush length:

Replace the brush if the brush length is less than service limit.

STANDARD (MM)	SERVICE LIMIT (MM)
10	5.5



### ARMATURE

#### Continuity check: commutator segments

Check the continuity between the segments. If an open circuit (no continuity) exists between any two segments, replace the armature.



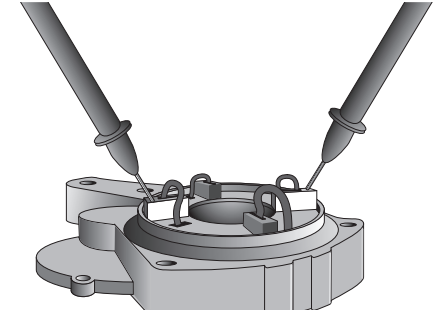
#### Continuity check: commutator to shaft

Check the continuity between commutator and the armature shaft. If continuity exists between any of the commutator segments and the armature shaft, replace the armature shaft.



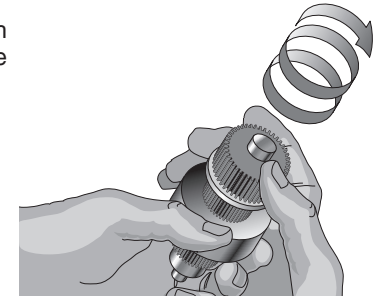
### BRUSHES - CONTINUITY CHECK

Remove the armature and check for continuity between the brushes. There should be no continuity between the brushes.



### OVERRUNNING CLUTCH

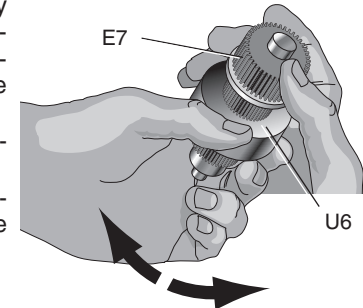
1. Check the overrunning clutch for smooth axial movement. Apply oil or replace the overrunning clutch, if necessary.



2. Check the reduction gear movement by holding the pinion gear (E7) and turning the reduction gear (U6). The reduction gear should turn counterclockwise freely and should not turn clockwise.

3. Check the pinion gear for wear or damage and replace if necessary.

**NOTE:** If the pinion gear is worn or damaged the flywheel ring gear must be inspected.





## Cylinder Head Valves

### 6.5 H.P.

- F7. Head Bolts (4)
- G7. Cylinder head cover
- G6. Spark plug
- I7. Head gasket
- J7. Gasket
- K7. Valve cover bolts (4)
- L7. Cylinder head
- M7. Valve spring retainer (2)
- N7. Valve rotator (2)
- O7. Push rod guide
- P7. Rocker arm (2)
- Q7. Valve spring (2)
- R7. Rocker arm pivot (2)
- S7. Rocker arm pivot nut (2)
- T7. Rocker arm pivot bolt (2)
- U7. Exhaust valve
- V7. Intake valve
- W7. Oil seal
- X7. Push rods (2)
- Y7. Air shroud
- Z7. Valve tappet (2)
- A8. Shroud bolts (2)

Loosen and tighten bolts in a crisscross pattern, taking 2-3 steps.

Clean spark plug. See **Spark Plug** under *Maintenance*.

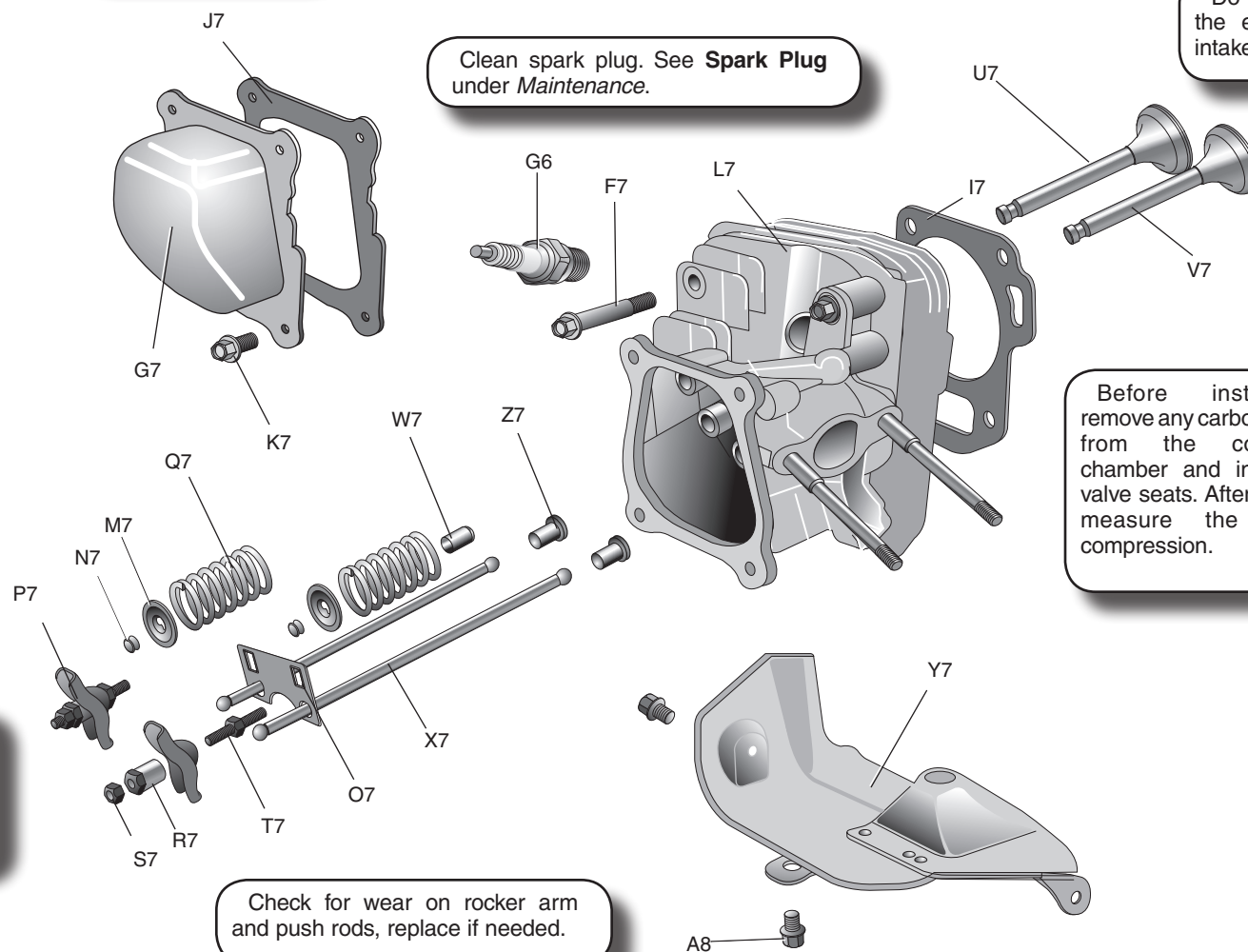
Do not interchange the exhaust (U7) and intake (V7) valves.

Before installation, remove any carbon deposits from the combustion chamber and inspect the valve seats. After assembly measure the cylinder compression.

Inspect valve spring (Q7).

**CAUTION:** Do not remove the valve spring (Q7) while the cylinder head is installed or the valves (U7, V7) will drop into the cylinder.

Check for wear on rocker arm and push rods, replace if needed.





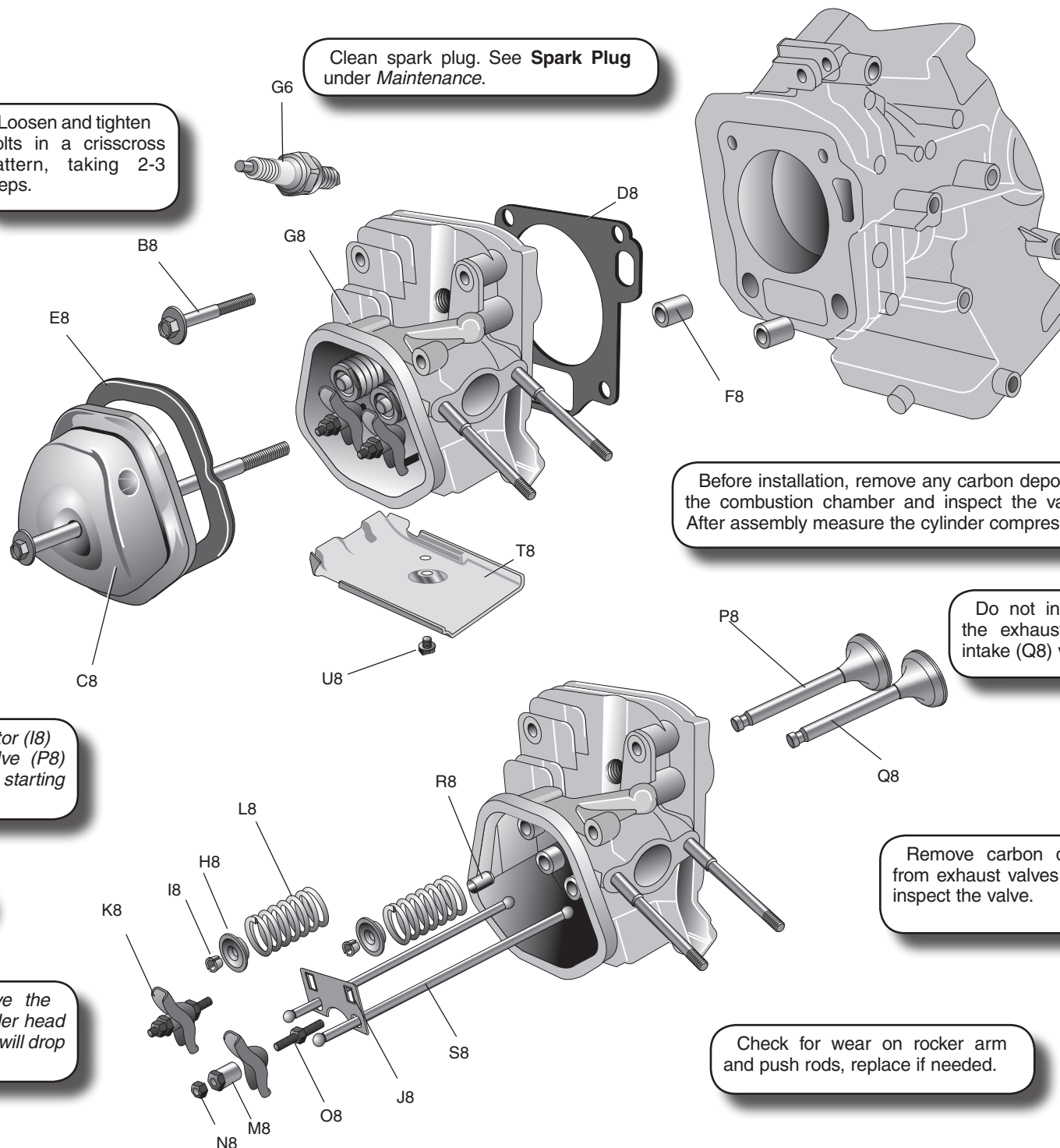
## Cylinder Head Valves

### 9 AND 13 H.P.

- B8. Head Bolts (4)
- C8. Cylinder head cover
- G6. Spark plug
- D8. Head Gasket
- E8. Gasket
- F8. Dowel pins (2)
- G8. Cylinder Head
- H8. Valve spring retainer (2)
- I8. Valve rotator (2)
- J8. Push rod guide
- K8. Rocker arm (2)
- L8. Valve spring (2)
- M8. Rocker arm pivot (2)
- N8. Rocker arm pivot nut (2)
- O8. Rocker arm pivot bolt (2)
- P8. Exhaust valve
- Q8. Intake valve
- R8. Oil Seal
- S8. Push rods (2)
- T8. Plate
- U8. Shroud bolt

Loosen and tighten bolts in a crisscross pattern, taking 2-3 steps.

Clean spark plug. See **Spark Plug** under *Maintenance*.



Before installation, remove any carbon deposits from the combustion chamber and inspect the valve seats. After assembly measure the cylinder compression.

Do not interchange the exhaust (P8) and intake (Q8) valves.

Remove carbon deposits from exhaust valves (P8) and inspect the valve.

Check for wear on rocker arm and push rods, replace if needed.

**CAUTION:** If the valve rotator (I8) is not installed the exhaust valve (P8) could drop into the cylinder when starting the engine.

Inspect valve spring (L8).

**CAUTION:** Do not remove the valve spring (L8) while the cylinder head is installed or the valves (P8, Q8) will drop into the cylinder.

## Inspection

### VALVE SPRING FREE LENGTH

Measure the free length of the valve springs.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	30 ~ 31	29.0
DW177	38.5 ~ 39.5	37.5
DW188	38.5 ~ 39.5	37.5

**NOTE:** Replace the springs if they are shorter than the service limit.

### VALVE SEAT WIDTH

Measure the valve seat width.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	0.7 ~ 0.9	2.0
DW177	0.7 ~ 0.9	2.0
DW188	0.7 ~ 0.9	2.0

**NOTE:** Recondition the valve seat if the width is under the standard or over the service limit.

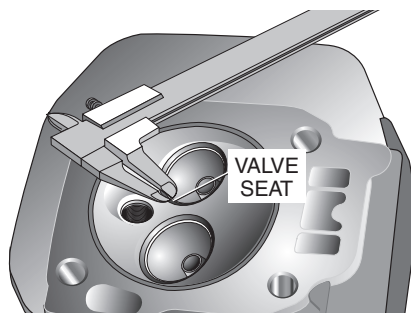
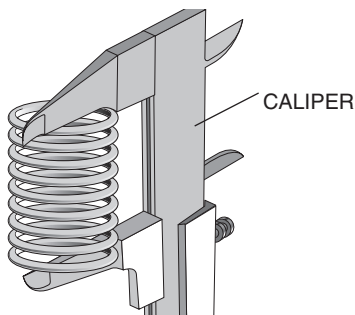
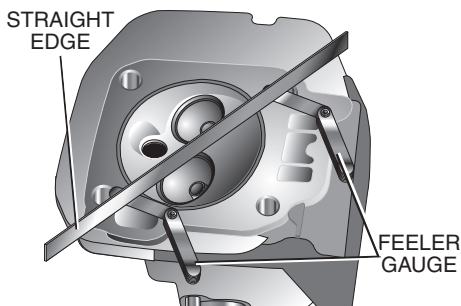
### CYLINDER HEAD

**▲WARNING:** Always wear certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields when removing carbon deposits.

**▲WARNING:** To reduce the possibility of fire or explosion, be careful when working around gasoline. Use only a nonflammable solvent, not gasoline, to clean parts. Keep smoking products, sparks and flames away from all fuel related parts.

- Remove carbon deposits from combustion chamber using a wire brush.
- Remove any gasket material from cylinder head surface.
- Check the spark plug hole and valve areas for cracks.
- Check the cylinder head for warpage with a straight edge and a feeler gauge.

STANDARD (MM)	SERVICE LIMIT (MM)
0	0.10



### VALVE STEM O. D.

Inspect each valve for:

- surface irregularities
- bending
- stem wear

Replace valve if needed.

Measure and record each valve stem O. D.

MODEL		STANDARD (MM)	SERVICE LIMIT (MM)
DW168	IN	5.468~5.48	5.318
	EX	5.418~5.44	5.275
DW177	IN	6.568~6.580	6.440
	EX	6.545~6.560	6.400
DW188	IN	6.568~6.580	6.440
	EX	6.545~6.560	6.400

**NOTE:** Replace the valves if the O. D. is smaller than the service limit.

### VALVE GUIDE I. D.

**NOTE:** ream the valve guides to remove any carbon deposits before measuring.

Measure and record each valve guide I. D.

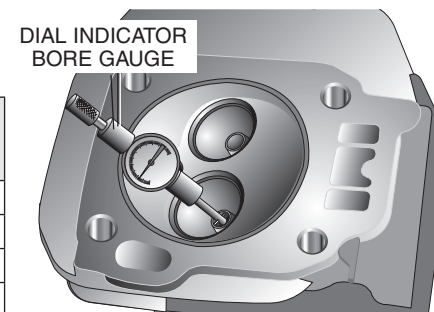
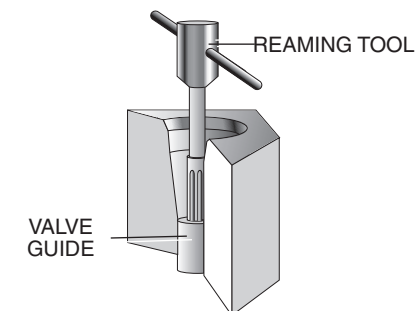
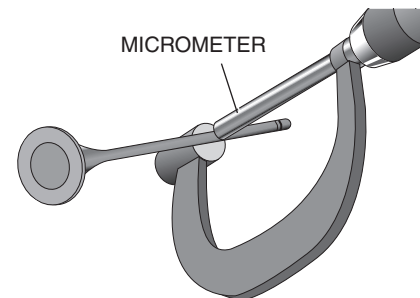
MODEL		STANDARD (MM)	SERVICE LIMIT (MM)
DW168		5.500~5.512	5.572
DW177		6.600~6.615	6.660
DW188		6.600~6.615	6.660

**NOTE:** Replace the valve guides if the I. D. is over the service limit.

### GUIDE TO STEM CLEARANCE

Subtract each valve stem O. D. from the corresponding guide I. D. to obtain the stem to guide clearance.

MODEL		STANDARD (MM)	SERVICE LIMIT (MM)
DW168	IN	0.020~0.044	0.10
	EX	0.060~0.084	0.12
DW177	IN	0.020~0.070	0.11
	EX	0.040~0.070	0.15
DW188	IN	0.020~0.070	0.11
	EX	0.040~0.070	0.15



If the stem to guide clearance exceeds the service limit:

Determine if the new guide with standard dimensions would bring the clearance within tolerance, if so replace any guide as necessary and ream to fit. If the stem to guide clearance exceeds the service limit with new guides, replace the valves also.

**NOTE:** Recondition the valve seats when valve guides are replaced.

### VALVE GUIDE REPLACEMENT

1. Drive the valve guides out of the head from the combustion chamber side using a valve guide driver.

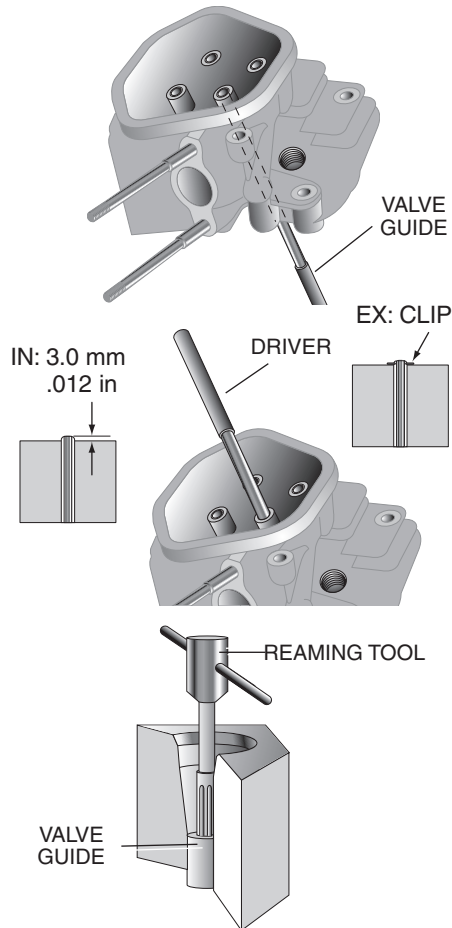
2. Install the new valve guides from the valve spring side of the cylinder head.

**Exhaust side:** Drive the exhaust valve guide until the clip is fully seated as shown.

**Intake side:** Drive the intake valve guide to the specified height (measure from the top of the valve guide to the cylinder casting as shown)

IN valve guide installation height	3.0 mm (0.12")
------------------------------------	----------------

3. After installation, inspect the valve guide for damage, replace if necessary.



### VALVE GUIDE REAMING

1. Coat the reamer and valve guide with cutting oil.
2. Rotate the reamer clockwise through the valve guide the full length of the reamer.
3. Continue to rotate the reamer clockwise while removing it from the valve guide.
4. Thoroughly clean the cylinder head to remove any cutting oil residue and chips.
5. Check the valve guide bore: it should be straight, round and centered in the valve guide. Insert the valve and check operation. If the valve does not operate smoothly, the guide may have been bent during installation. Replace the valve guide if it is bent or damaged.
6. Check the Valve Guide to Stem Clearance.



CORRECT

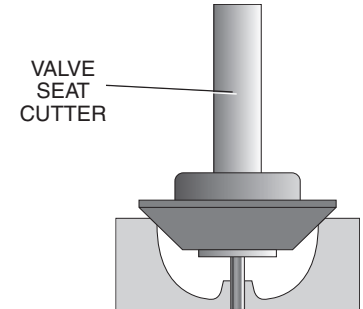
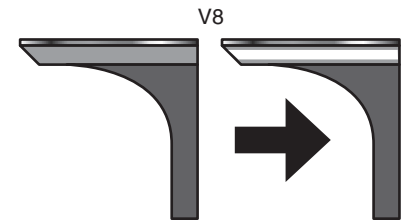


INCORRECT

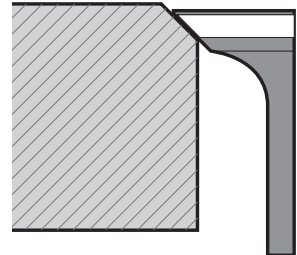
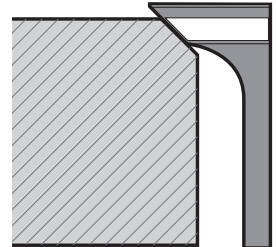
### VALVE SEAT RECONDITIONING

1. Clean the combustion chamber and valve seats (V8) to remove carbon deposits.
2. Apply a light coat of Prussian Blue or erasable felt-tipped marker on valve face.
3. Insert the valve and snap it closed against the seat several times. Ensure the valve does not rotate on the seat. The transferred marking compound will show any area of the seat this is not concentric.

**NOTE:** Follow the valve seat cutter manufacture instructions.

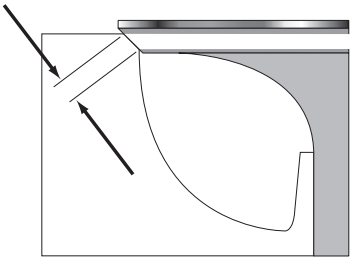


4. Use a 45° cutter to remove enough material to produce a smooth and concentric seat. Turn the cutter clockwise, never counterclockwise. Continue to turn the cutter while lifting it from the valve seat.
5. Use a 30° – 32° and 60° cutter to narrow and adjust the valve seat so it contacts the middle of the valve face. Use a 30° – 32° cutter to remove material from the bottom edge (contact too low). Use a 60° cutter to remove material from the top edge (contact too high). Ensure the width of the finished valve seat is within specifications.



VALVE SEAT WIDTH

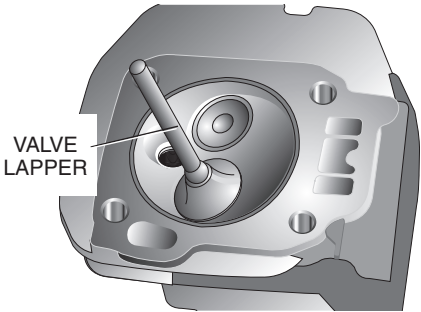
MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	0.7~0.9	2.0
DW177	0.7~0.9	2.0
DW188	0.7~0.9	2.0



6. Make a light pass with a 45° cutter to remove any possible burrs at the edges of the seat.
7. After resurfacing the seats, inspect for even valve seating. Apply a light coat of Prussian Blue or erasable felt-tipped marker onto the valve face. Insert the valve and snap it closed against the seat several times. Ensure the valve does not rotate on the seat.  
The transferred marking compound should show the seating surface has good contact all the way around.
8. Lap the valves into their seats using a hand valve lapper and lapping compound (commercially available).

**CAUTION:** Risk of property damage. Ensure all lapping compound is removed from the engine before reassembly.

**NOTE:** Adjust the valve clearance after reassembly.



## Governor/Low Oil Shut-off

W8. Oil seal (2)  
X8. Crankcase cover  
Y8. Balancer bearing (2)  
Z8. Crankcase cover gasket  
A9. Washer (2)  
B9. Governor weight holder  
C9. Governor weight pin (3)  
D9. Governor weight (3)  
E9. Governor holder  
F9. Governor slider

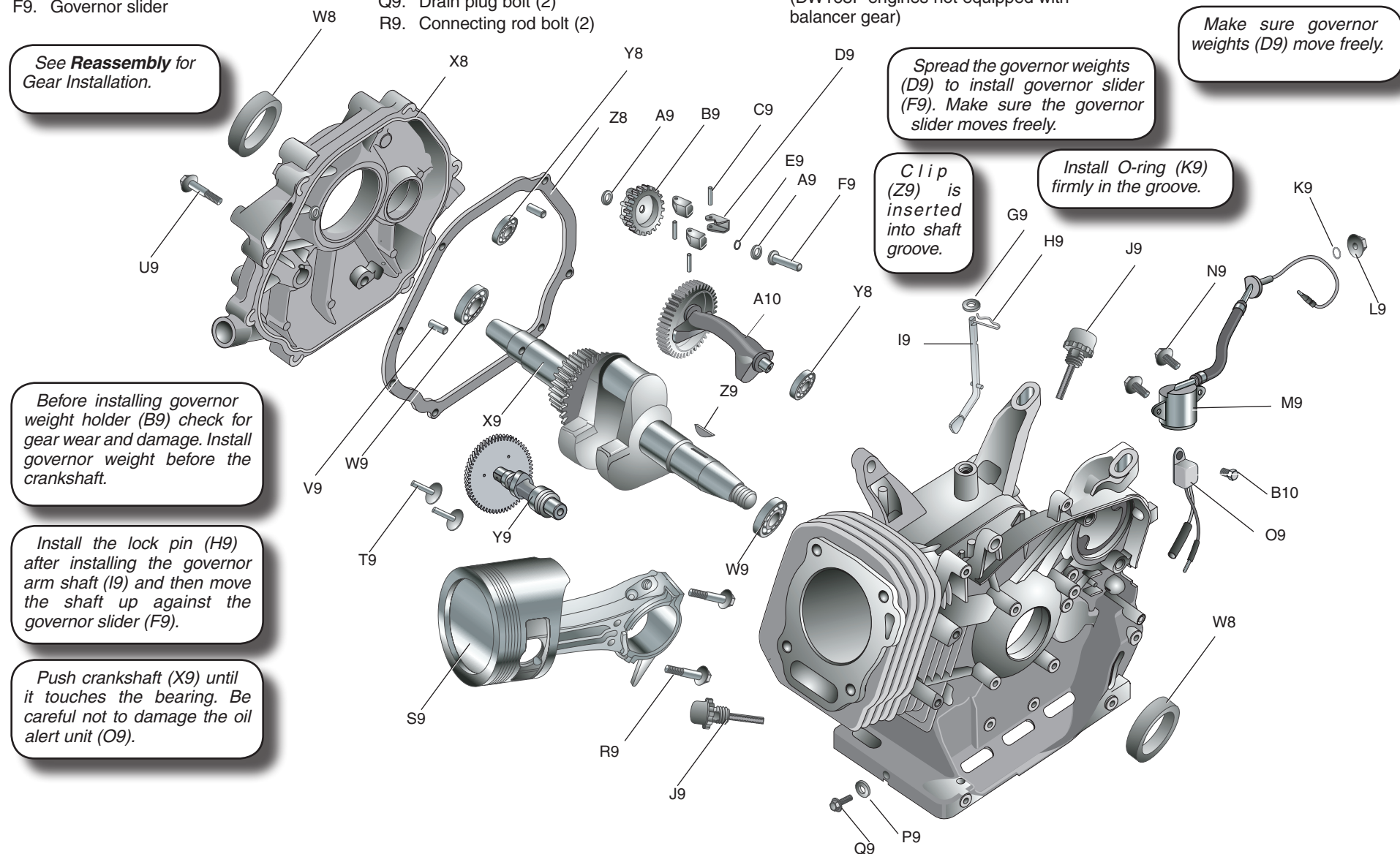
G9. Washer  
H9. Lock pin  
I9. Governor arm shaft  
J9. Dipstick (2)  
K9. O-Ring  
L9. Flange nut  
M9. Oil level switch assembly  
N9. Bolts, Oil level switch assembly (2)  
O9. Oil alert unit  
P9. Drain plug washer (2)  
Q9. Drain plug bolt (2)  
R9. Connecting rod bolt (2)

S9. Piston Assembly  
T9. Valve lifters (2)  
U9. Crankcase cover bolt (2)  
V9. Dowel pin (2)  
W9. Main bearing (2)  
X9. Crankshaft  
Y9. Camshaft  
(see *Compression Relief* breakdown)  
Z9. Crankshaft key  
A10. Balancer gear  
(DW168F engines not equipped with balancer gear)

B10. Bolt, oil alert unit

### IMPORTANT NOTES FOR DW168F ENGINES

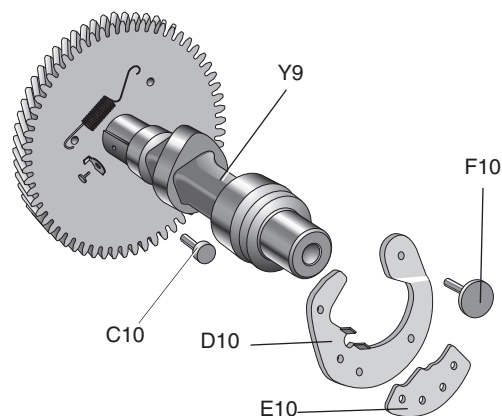
- The governor gear assembly is installed in a plain bearing in the crankcase.
- The governor drive gear is installed on the flywheel journal of the crankshaft.





## Compression Relief

- Y9. Camshaft  
C10. Reducer pin  
E10. Flying block  
D10. Matching block  
F10. Flying block pin



## REASSEMBLY

### Timing Gear

Use the old gear as reference and make a mark at the same position on the new gear.  
Use a hydraulic press, driver and attachment I. D. (special tool) to press the new gear onto the crankshaft.

DW168	
Driver 40 mm I.D.	07746 – 0030100
Attachment, 25 mm I.D.	07746 – 0030200
DW177 and DW188	
Driver 40 mm I.D.	07746 – 0030100
Attachment, 30 mm I.D.	07746 – 0030300

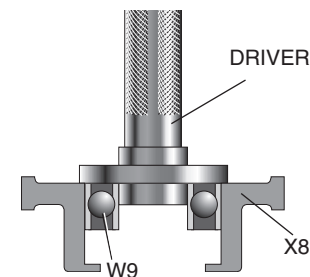
### Governor Drive Gear

Use a hydraulic press, driver and attachment I. D. (special tool) to press the new governor drive gear onto the crankshaft.

DW168	
Driver 40 mm I.D.	07746 – 0030100
Attachment, 30 mm I.D.	07746 – 0030300
DW177 and DW188	
Driver 40 mm I.D.	07746 – 0030100
Attachment, 35 mm I.D.	07746 – 0030400

## Crankshaft Bearing

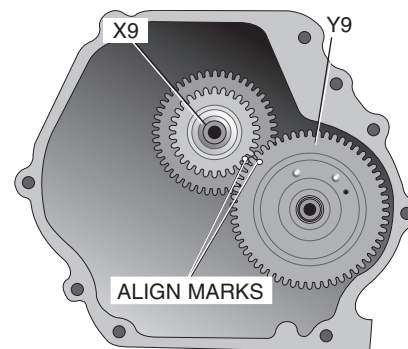
Use a hydraulic press and driver with a diameter larger than crankcase cover (X8) opening to press the new bearing (W9) onto the crankshaft.



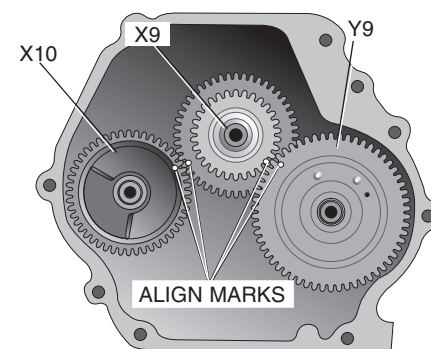
## Timing Mark Alignment

**NOTE:** Balancer gear equipped on DW188F engines only, for DW168F and DW177F engines proceed to step 2.

1. With crankshaft (X9) installed in crankcase install balancer (A10). **NOTE:** Align marks on balancer and balancer drive gear of crankshaft.
2. Install the camshaft aligning marks on camshaft (Y9) with those on timing gear of crankshaft.



DW168F, DW177F

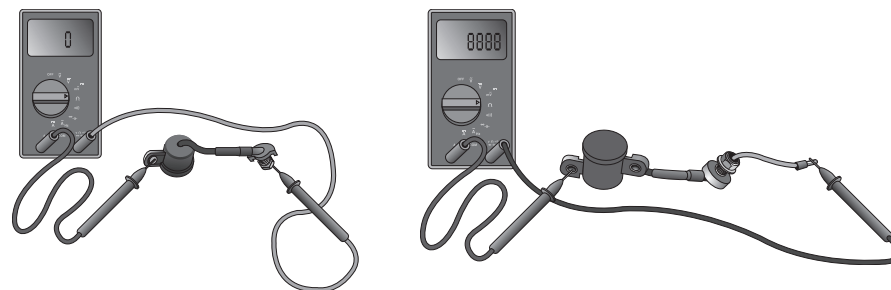


DW188F

## Inspection

### OIL LEVEL SWITCH (DW177, DW188)

1. With the switch in the normal upright orientation test the continuity between the yellow lead and the face of the brass ground connector as show. The ohm meter should read approximately zero resistance.
2. Hold the switch upside down to simulate the float's position in the crankcase when it is filled with oil. Test the continuity in the same way between the face of the brass ground connector and the yellow lead. The ohm meter should read approximately infinite resistance.
3. If either test yields an incorrect reading replace the low oil shutdown unit.

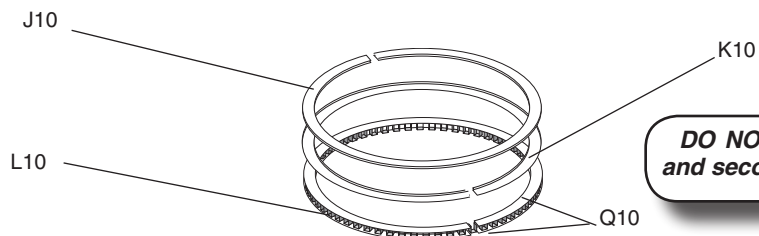




## Piston

- J10. Top ring
- K10. Second ring
- L10. Oil ring
- M10. Piston
- N10. Connecting rod
- O10. Piston pin
- P10. Piston pin clip (2)
- Q10. Bushing rings (2)

**Markings on rings must face upward.**

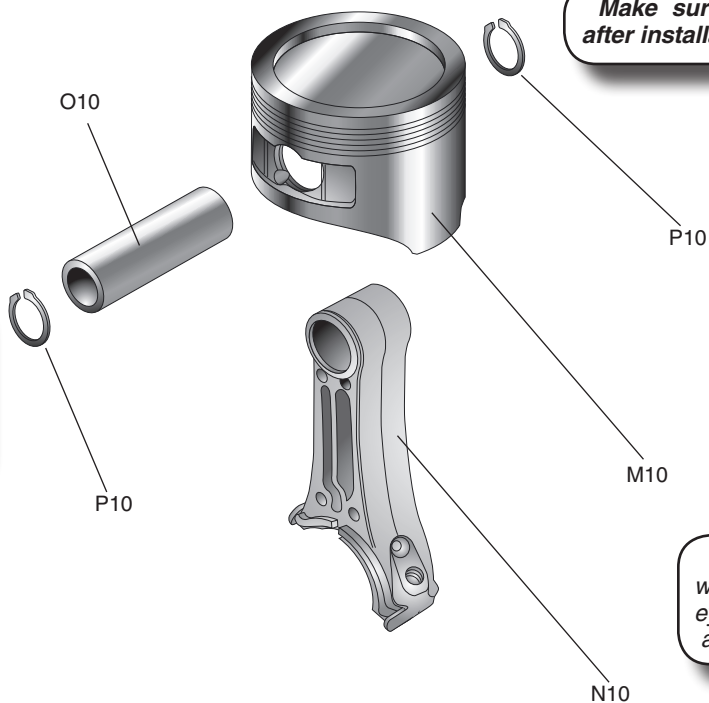


**DO NOT interchange the top (J10) and second rings (K10).**

**Make sure rings rotate smoothly after installation.**

**The piston ring end gaps should be 120° apart. DO NOT align the gaps with the piston pin bore.**

**Place one end of the piston pin clip (P10) into the piston groove, hold the other end with needle nose pliers and rotate clip into piston groove. DO NOT align clip end gap with cutout in the piston pin bore.**



**⚠ WARNING:** Risk of unsafe operation. Always wear gloves and certified safety equipment: ANSI Z87.1 eye protection (CAN/CSA Z94.3) with side shields when assembling and disassembling.

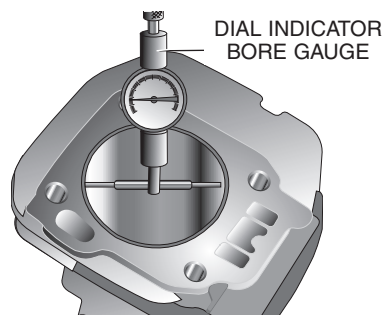
## INSPECTION

### CYLINDER I.D.

Measure and record the cylinder I.D. at three levels in both the "X" axis (perpendicular to the crankshaft) and the "Y" axis (parallel to crankshaft).

Take the maximum reading to determine cylinder wear and taper.

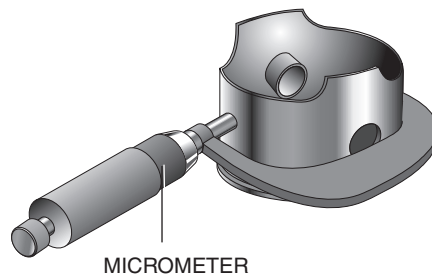
MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	68.015~68.025	68.156
DW177	77.02~77.03	77.179
DW188	88.015~88.025	88.195



### PISTON SKIRT O.D.

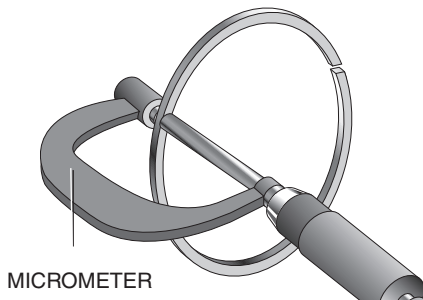
Measure and record the piston O.D. at a point of 10 mm (0.4") from the bottom of the skirt and 90° to the piston pin bore.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	67.975~67.985	67.850
DW177	76.970~76.980	76.850
DW188	87.970~87.980	87.850



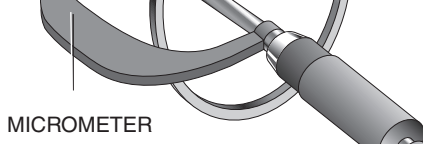
### PISTON TO CYLINDER CLEARANCE

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	0.030~0.050	0.120
DW177	0.040~0.060	0.100
DW188	0.045~0.065	0.100



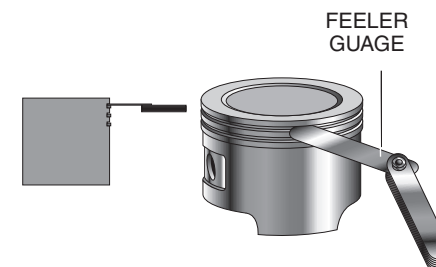
### PISTON RING WIDTH

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	1.450	1.200
DW177	2.000	1.750
DW188	2.000	1.250



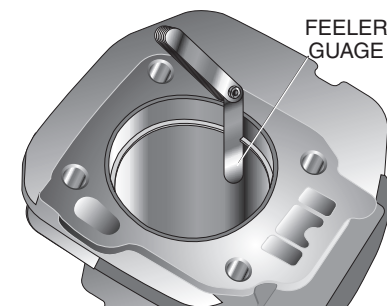
### PISTON RING SIDE CLEARANCE

RING, TOP		
MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	0.08~0.12	0.10
DW177	0.02~0.06	0.15
DW188	0.02~0.06	0.15



### PISTON RING END GAP

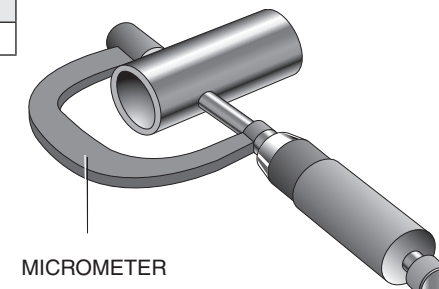
MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	0.15~0.35	1.00
DW177	0.20~0.35	1.00
DW188	0.20~0.40	1.00



**NOTE:** Use the top of the piston to position the ring horizontally in the cylinder.

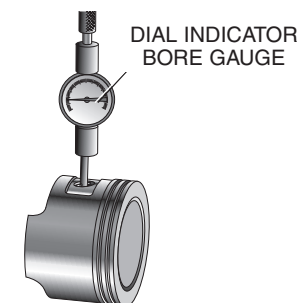
### PISTON PIN O. D.

STANDARD (MM)	SERVICE LIMIT (MM)
17.992~17.998	17.940



### PISTON PIN BORE I. D.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	18.002~18.008	18.042
DW177	18.002~18.008	18.042
DW188	20.002~20.008	20.042

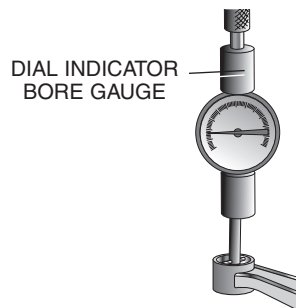


## PISTON PIN TO PISTON PIN BORE CLEARANCE

STANDARD (MM)	SERVICE LIMIT (MM)
0.004~0.016	0.08

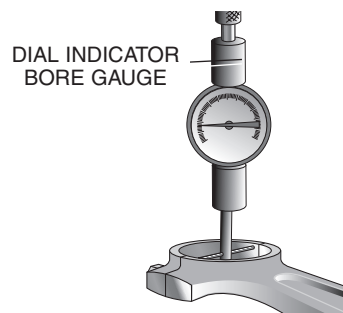
## CONNECTING ROD SMALL END I. D.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	18.011~18.022	18.06
DW177	18.011~18.022	18.06
DW188	20.011~20.022	20.06



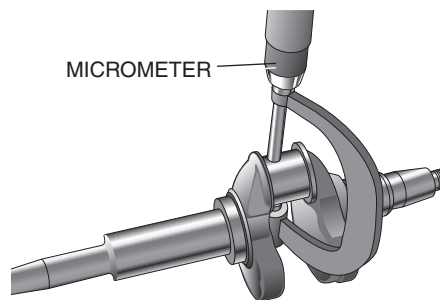
## CONNECTING ROD BIG END I. D.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	30.02~30.03	30.06
DW177	33.02~33.03	33.06
DW188	36.02~36.03	36.06



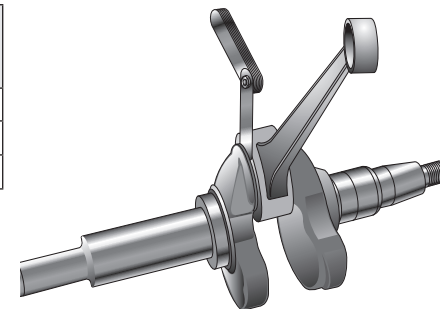
## CRANKPIN O. D.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	30.00	29.94
DW177	33.00	32.94
DW188	36.00	35.94



## CONNECTING ROD BIG END SIDE CLEARANCE

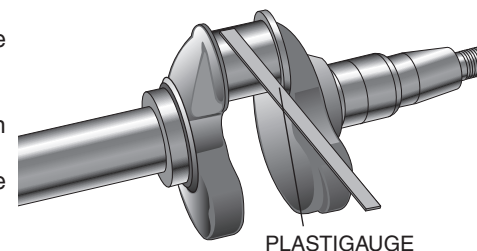
MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	0.95~1.45	1.85
DW177	0.55~1.25	1.65
DW188	0.55~1.25	1.65



## CONNECTING ROD BIG END OIL CLEARANCE

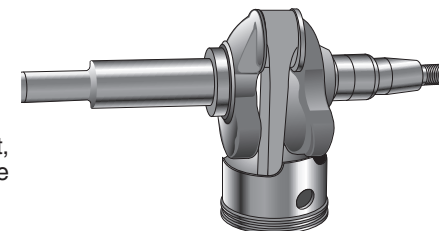
1. Clean all oil from the crank pin and connecting rod big end surfaces.
2. Place a piece of plastigauge on the crank pin.
3. Install the connecting rod and cap.
4. Tighten the bolts and torque to 12 N•m (1.2 Kg-m, 9 ft.-lbs.).

**NOTE:** Do not rotate the crankshaft with the plastigauge in place.



5. Remove the connecting rod and measure the plastigauge.

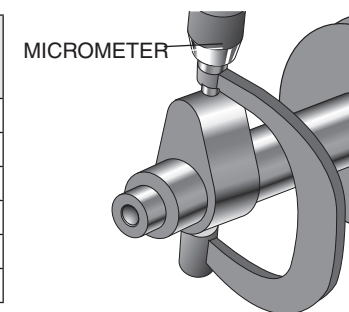
STANDARD	SERVICE LIMIT
0.04~.066	0.12



6. If the clearance exceeds the service limit, replace the connecting rod and recheck the clearance.

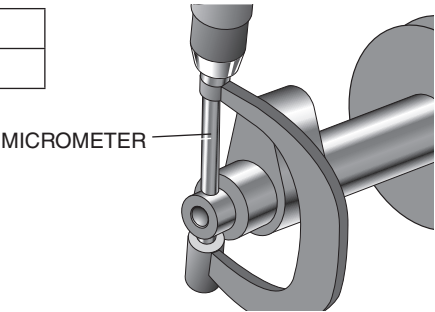
## CAMSHAFT CAM HEIGHT

MODEL		STANDARD (MM)	SERVICE LIMIT (MM)
DW168	IN	27.700	27.45
	EX	27.747	27.50
DW177	IN	31.716	31.35
	EX	31.754	31.35
DW188	IN	32.585	32.25
	EX	32.068	31.80



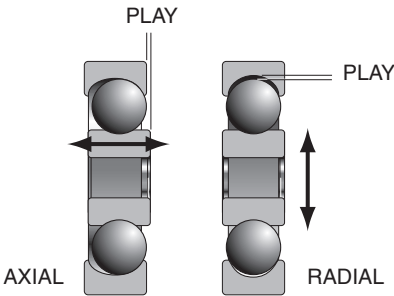
CAMSHAFT O. D.

STANDARD	SERVICE LIMIT
13.966~13.984	13.916



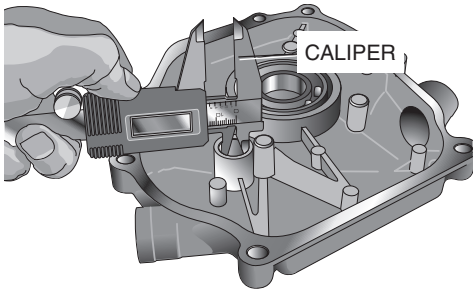
CRANKSHAFT BEARING FREE PLAY

1. Clean the bearing in solvent and dry.
2. Spin the bearing by hand and check for play.  
Replace the bearing if it is noisy or has excessive play.



CAMSHAFT HOLDER I.D.

MODEL	STANDARD (MM)	SERVICE LIMIT (MM)
DW168	14.000~14.018	14.050
DW177	16.000~16.018	16.050
DW188	16.000~16.018	16.050











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